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MEAT SITUATION IN THE UNITED STATES.

PART II.

LIVE STOCK PRODUCTION IN THE ELEVEN FAR WESTERN RANGE STATES.

BASED ON REPORTS FROM STOCKMEN AND COUNTY CORRESPONDENTS.

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EXPLANATORY STATEMENT.

In the winter of 1913–14 a committee of well-known investigators, familiar with agricultural conditions, was appointed by the Secretary of Agriculture to consider the economics of the meat situation. This committee was composed of Dr. B. T. Galloway, Assistant Secretary of Agriculture, as chairman; Dr. H. J. Waters, president of the Kansas State Agricultural College; Prof. C. F. Curtiss, Dean of the Iowa State College of Agriculture and Mechanic Arts and director of the Iowa Agricultural Experiment Station; H. W. Mumford, Professor of Animal Husbandry, University of Illinois; Dr. A. D. Melvin, Chief of the Bureau of Animal Industry, U. S. Department of Agriculture; and Dr. T. N. Carver, director of the Rural Organization Service, U. S. Department of Agriculture. Mr. Leon M. Estabrook, Chief of the Bureau of Crop Estimates, was made secretary of the committee.

No formal report was prepared by this committee, but, at the suggestion of the committee, independent inquiries dealing with several phases of the meat situation were undertaken by specialists of the United States Department of Agriculture. The results of these inquiries have been crystallized by the department in a series of five reports, under the general title of the "Meat Situation in the United States," each report complete within itself and bearing a separate number in the series of reports of the Office of the Secretary, as follows:

Part I. Statistics of Live Stock, Meat Production and Consumption, Prices, and International Trade for Many Countries. By George K. Holmes, Bureau of Crop Estimates. (Report No. 109.)

Part II. Live Stock Production in the Eleven Far Western Range States. By Will C. Barnes and James T. Jardine, Branch of Grazing, Forest Service. (Report No. 110.)

Part III. Methods and Cost of Growing Beef Cattle in the Corn Belt States. By J. S. Cotton and Morton O. Cooper, Office of Farm Management, and W. F. Ward and S. H. Ray, Animal Husbandry Division, Bureau of Animal Industry. (Report No. 111.)

Part IV. Utilization and Efficiency of Available American Feed Stuffs. By W. F. Ward and S. H. Ray, Animal Husbandry Division, Bureau of Animal Industry. (Report No. 112.)

Part V. Methods and Cost of Marketing Live Stock and Meats. By Louis D. Hall, F. M. Simpson, and S. W. Doty, Office of Markets and Rural Organization. (Report No. 113.)

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LIVE STOCK PRODUCTION IN THE ELEVEN FAR WESTERN RANGE STATES.

GENERAL SUMMARY.

Summing up the meat production questions in the 11 far western range States, it is apparent that—

(1) The long downward curve in numbers of live stock has probably reached the bottom, and should slowly rise.

(2) The future cost of producing meats on the western ranges will certainly not be less and in most sections will probably increase.

(3) Better stock, better methods, better care, and possible reductions of losses due to starvation, predatory animals, poisonous plants, etc., will doubtless tend to stimulate the rise in numbers and somewhat check the rise in production costs.

A widespread campaign of education by the States and the Federal Government working in cooperation among the stockmen and farmers should aid materially in increasing the output of meats and in minimizing the cost of production.

CHARACTER OF THE INQUIRY.

For the purposes of this investigation the territory included within the following 11 States was assigned to the Forest Service for study: Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

To supplement personal information collected during the field season by the two investigators, schedules were secured from representative stockmen selected by the 160 supervisors of National Forests in these States to present data on range conditions and range live stock production on and adjoining the National Forests. An additional set of schedules was received through the Bureau of Crop Estimates from county correspondents of that bureau. Full and complete reports and estimates were also secured from Forest officers in close touch with the stock industry. The investigations were conducted during the summer of 1914. The data and conclusions presented therefore apply primarily to conditions in 1914 as compared with conditions prior to 1914.

In order to minimize generalizations and determine as nearly as possible the comparative influence of important factors which have

been responsible for the changes in production, as well as to ascertain the possible future changes in production and the feasible means of increasing production in future, the individual reports were secured approximately by county units. These were studied individually and in groups by larger units within a State similar in conditions affecting live stock production. Conclusions and estimates were then made by States and finally assembled into conclusions for the territory (11 States) assigned to the Forest Service.

The data are presented in three sections:

(1) Live stock production on western ranges, including changes in production since 1910, the main factors responsible for these changes, and the possibilities for increase in production.

(2) Cost of production at present under western range conditions.

(3) Brief discussion of conditions in each State included in the investigations.

LIVE STOCK PRODUCTION ON WESTERN RANGES.

CHANGES IN NUMBER OF CATTLE AND SHEEP SINCE 1910.

Table 1 shows the estimated percentage changes in the number of cattle and sheep on the ranges of the States studied since 1910, and the corresponding increase or decrease in actual number, as computed from the estimated percentage changes and the 1910 census figures on actual number of stock.[1]

TABLE 1.—*Changes in number of cattle and sheep on western ranges, 1910 to 1914, inclusive.*

State.	Cattle.				Sheep.			
	Increase.		Decrease.		Increase.		Decrease.	
	Per cent.	Number.[2]	Per cent.	Number.[2]	Per cent.	Number.[2]	Per cent.	Number.[2]
Arizona			6	47,760	10	122,700		
California			10	161,000			15	362,550
Colorado	2	19,660			10	142,600		
Idaho			10	36,800			11.8	355,298
Montana			26	225,160			40	2,152,400
Nevada			10	43,300	20	231,000		
New Mexico			10	103,000			10	334,700
Oregon			10	55,200			15	404,850
Utah			7.5	25,200			14	255,780
Washington			16	34,560	4	19,040		
Wyoming			20	146,800			22	1,187,340
Total		19,660		878,780		515,340		5,052,918
Net			8.6	859,120			16	4,537,578

[1] Agricultural Outlook, Feb. 7, 1914, Farmers' Bulletin 575.

[2] Census 1910, cattle other than milch cows taken as a basis of computation; total sheep used.

Considering four sheep the equivalent of one cow, the 1910 figures and the estimated decrease since 1910 may be reduced, for comparative purposes later, to cow units, as follows:

Total cattle other than milch cows, 1910	7,925,000
Total sheep 1910 (28,363,000) cow units	7,090,750
Total cow units, 1910	15,015,750
Net decrease in cattle since 1910	859,120
Net decrease in sheep since 1910 (4,537,576), cow units	1,134,394
Total decrease since 1910, cow units	1,993,514

This means a net decrease of approximately 13 per cent in the total meat animals (cattle and sheep) produced on the ranges in the 11 far western States in 1914 as compared with 1910. The geographic changes are best shown on the accompanying maps (cattle, facing p. 8; sheep, facing p. 12) and in the digest, by States, of schedules received from stockmen and county correspondents (pp. 50–98).

CAUSES OF THE CHANGES.

The factors which have operated to bring about the net decrease of 13 per cent are many. Those tending to decrease production are: (1) Entry and settlement of range lands; (2) high prices of live stock, coupled with uncertainty as to future conditions: (3) difficulty of getting long-time loans for the purchase of breeding stock and comparative ease of securing money for the purchase of feeders; (4) increase in price of land and increase in price of dairy products, operating together to bring about a slight change from beef production to dairying; (5) improvement in grade and weight of animals, somewhat at the expense of numbers; (6) drought and severe winters; (7) range deterioration.

On the other hand, the high price of meat, as compared with the prices of other farm products and the general development of farms, with resulting increase in hay production, have tended toward increased production of live stock, especially during the latter half of the period of years from 1910 to 1914.

SETTLEMENT.

The entry and settlement of lands previously used as range has undoubtedly had the most direct and by far the greatest influence in bringing about the net reduction in the number of live stock produced on the ranges of the far western States during the period from 1910 to 1914, inclusive. It is impossible to make a mathematically exact statement of the decrease due to this factor, but in the computations which follow the effect of settlement is viewed from

several angles, and what is believed to be a fair estimate of the net results is obtained.

Table 2 shows the public lands entered in each of the 11 States under consideration, together with the total, from 1909 to July 1, 1914, as given in the 1914 report of the Commissioner of the General Land Office.

TABLE 2.—*Public lands entered each year ended June 30, from 1909 to 1914, inclusive.*

[Acres.]

State.	1909	1910	1911	1912	1913	1914	Total.
Ariz	468,160.64	541,793.23	486,066.86	669,292.97	770,449.59	765,962.11	3,701,725.40
Cal	1,290,574.46	1,214,248.36	1,064,644.89	872,301.68	937,230.43	878,874.21	6,257,979.03
Colo	1,983,078.58	3,994,757.50	2,272,068.99	1,354,326.05	1,458,107.84	1,433,305.88	12,495,644.84
Idaho	1,383,443.88	1,768,010.34	1,191,012.91	860,840.25	1,030,312.55	947,553.93	7,181,173.86
Mont	2,460,905.55	6,616,734.69	4,659,232.48	3,687,420.90	4,717,117.51	5,386,954.28	27,528,365.41
Nev	78,190.07	261,125.24	312,510.88	261,188.07	173,799.66	194,308.33	1,281,122.25
N. Mex	2,542,799.18	1,924,145.46	1,377,563.07	1,050,399.79	2,324,250.89	1,870,138.66	11,089,297.05
Oreg	1,091,530.56	1,050,723.53	742,049.86	745,869.45	561,810.14	839,990.89	5,031,974.43
Utah	619,802.07	577,459.86	693,770.08	549,883.11	262,863.44	189,781.34	2,893,559.90
Wash	608,546.35	360,789.20	481,459.19	382,565.57	357,323.51	294,930.73	2,685,614.55
Wyo	897,479.96	1,377,063.74	1,167,042.50	503,090.10	655,255.75	927,007.95	5,526,940.00
Total	13,424,516.30	19,886,951.15	14,447,421.71	10,937,177.94	13,248,521.31	13,728,808.31	85,673,396.72

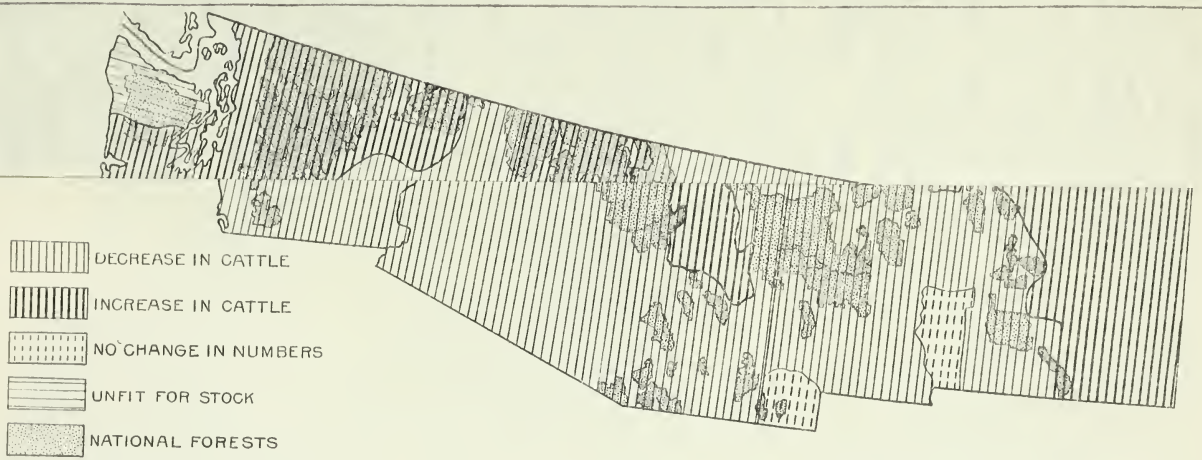
These 85,673,396.7 acres, taken from the open ranges of the 11 western States since 1909, undoubtedly represent areas with an average carrying capacity considerably above that of the remaining lands. Assuming that the carrying capacity figures deduced from the schedules received in connection with this investigation are fairly reliable estimates of the acreage necessary to support one cow, the carrying capacity of the lands entered since 1909 would be as shown in Table 3.

TABLE 3.—*Carrying capacity of public lands entered from 1909 to July 1, 1914.*

State.	Land entered 1909–1914.	Area necessary for one cow.	Carrying capacity of land entered.
	Acres.	*Acres.*	*Number cows.*
Arizona	3,701,725.40	35	105,763
California	6,257,979.03	[1] 20	212,898
Colorado	12,495,644.84	[1] 20	624,782
Idaho	7,181,173.86	18	398,954
Montana	27,528,365.41	15	1,835,224
Nevada	1,281,122.25	[1] 30	427,040
New Mexico	11,089,297.05	[1] 25	443,572
Oregon	5,031,974.43	[1] 20	251,598
Utah	2,893,559.90	[1] 20	144,678
Washington	2,685,614.55	20	134,280
Wyoming	5,526,940.00	[1] 20	276,347
Total	85,673,396.72	.....	4,855,136

[1] Slightly lower than average for remaining lands, owing to lands entered being better range than the average of the remaining lands.

The deductions following Table 1 (p. 6) show the total cattle and sheep in 1910 to be the equivalent of 15,015,750 cow units. The



INCREASE AND DECREASE IN CATTLE PRODUCTION
1910—1914 INCLUSIVE

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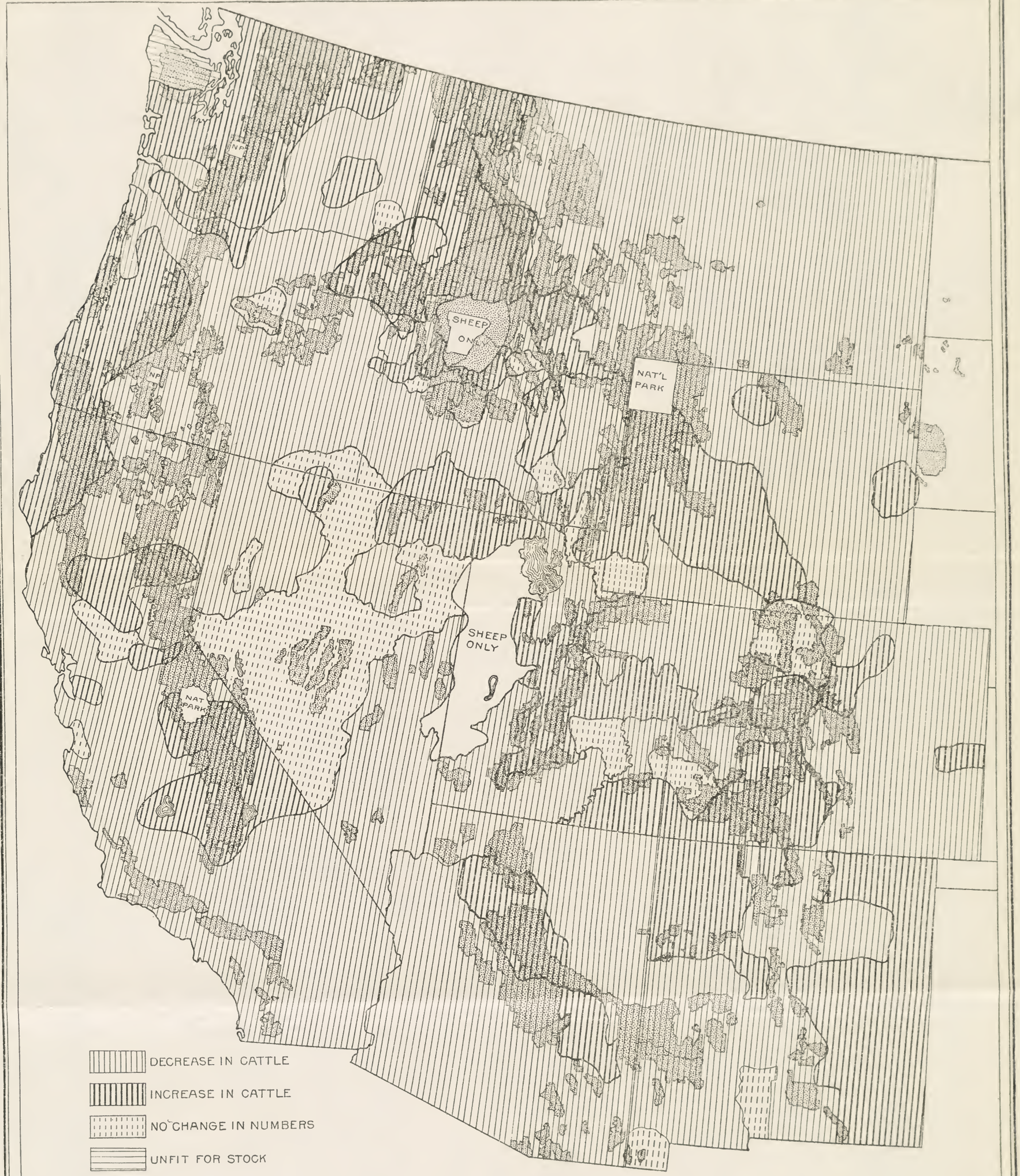

INCREASE AND DECREASE IN CATTLE PRODUCTION
1910—1914 INCLUSIVE

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estimated carrying capacity, then (4,855,136 cows), of the lands entered since 1909 is equivalent to approximately 32 per cent of the total live stock on the ranges in these same States in 1910. This is believed to be about right, but it remains now to decide to what extent the lands entered are still producing live stock.

The reports and schedules received in connection with this investigation indicate that the majority of the new settlers (probably 70 per cent) are not raising any live stock over and above their necessary work and milch animals, owing largely to the fact that when they file on the land the majority of them have no credit and barely enough money for necessary equipment and improvements. In those cases in which the settlers are raising more than the necessary work and milch animals the number of animals produced on the entered lands probably exceeds the number supported by these lands prior to settlement. Assuming the proportion of such settlers to be 30 per cent, which is believed to be a maximum, the carrying capacity of the area entered since 1909 is still equivalent to approximately 22 per cent of the total live stock on the ranges in question in 1910.

No figures or estimates are available to show what proportion of the lands entered have actually been placed under cultivation, but without doubt a considerable acreage is still in native pasture on those holdings which are not raising more than milch and work animals. In such cases the available pasture not used by milch cows and work horses usually is rented to stockmen and, consequently, is still used in connection with range live stock. If the acreage so used is placed at 20 per cent of the total acreage of range lands entered, it means a further reduction of the decrease in range live stock, due to settlement, from 22 per cent, as just given, to 16 per cent of the total range live stock in 1910. In other words, one-half of the 85,673,396.7 acres of public lands entered from 1909 to July, 1914, inclusive, is still used in some form or other for the production of live stock other than milch and work animals. According to this method of computation, the estimated net reduction in live stock on the ranges in the far western States since 1910 due to settlement is 16 per cent.

In each of the great number of schedules from stockmen and county correspondents an estimate was given of the decrease in total live stock which has resulted from settlement. These estimates have been carefully studied and averaged by States, and a final estimate has been adopted for this factor in each State. Table 4 gives these estimates by States, the corresponding computed increase or decrease in cattle or sheep, the total increase, the total decrease, and the net decrease.

TABLE 4.—*Estimate of decrease or increase in live stock due to settlement, based upon schedules returned from stockmen and county correspondents to the Bureau of Crop Estimates.*

State.	Cattle.				Sheep.			
	Increase.		Decrease.		Increase.		Decrease.	
	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.
Arizona			4.2	33,432			5	61,450
California			5	80,500			10	241,700
Colorado			6	58,980			10	142,600
Idaho			10	36,800			12.9	388,419
Montana			30	259,800			38	2,044,780
Nevada			3	12,990			0	
New Mexico			5	51,550			12	401,640
Oregon			9	49,680			11	296,890
Utah			3	10,080			8	146,160
Washington	6	12,960			3	14,280		
Wyoming			0				14	755,580
Total		12,960		593,812		14,280		4,452,219
Net				580,852				4,437,939

Transforming the 4,437,939 sheep to a cattle equivalent, on the basis of one cow to four sheep, gives a total decrease of 1,690,337 cow units due to settlement. The total cow units in 1910, as given following Table 1, amounted to 15,015,750. The reduction of 1,690,337 cow units, due to settlement, as deduced from the individual estimates of Table 4, therefore, represents a decrease of approximately 11¼ per cent in live stock, for the States under study.

The question relative to decrease in live stock due to settlement was so worded as to result in estimates based on total live stock rather than purely range stock. For this reason the 11¼ per cent of estimated decrease may be considered slightly low, owing to the fact that there has been a marked increase in milch cows. Further, thousands of acres of railroad lands, not properly considered in this computation and certainly not in the estimate of lands entered from 1909 to 1914, have passed to private ownership and have been transformed into grain fields.

Since the figures deduced by the two methods to represent decrease in live stock due to settlement (16 per cent in one case and 11¼ per cent in the other) are so near together, and, further, since the 11¼ per cent should be slightly increased in order to eliminate the increase in milch cows and represent range live stock other than milch cows, it is a fair conclusion that the number of live stock on the ranges in the 11 far western States has been reduced approximately 15 per cent by the entry and settlement of public lands in these States since 1909. The explanation of the excess of this decrease over the total estimated decrease from all causes since 1910, as shown by Table 1, is given in the discussions of other factors following.

HIGH PRICES OF MEAT AND UNCERTAINTY AS TO FUTURE.

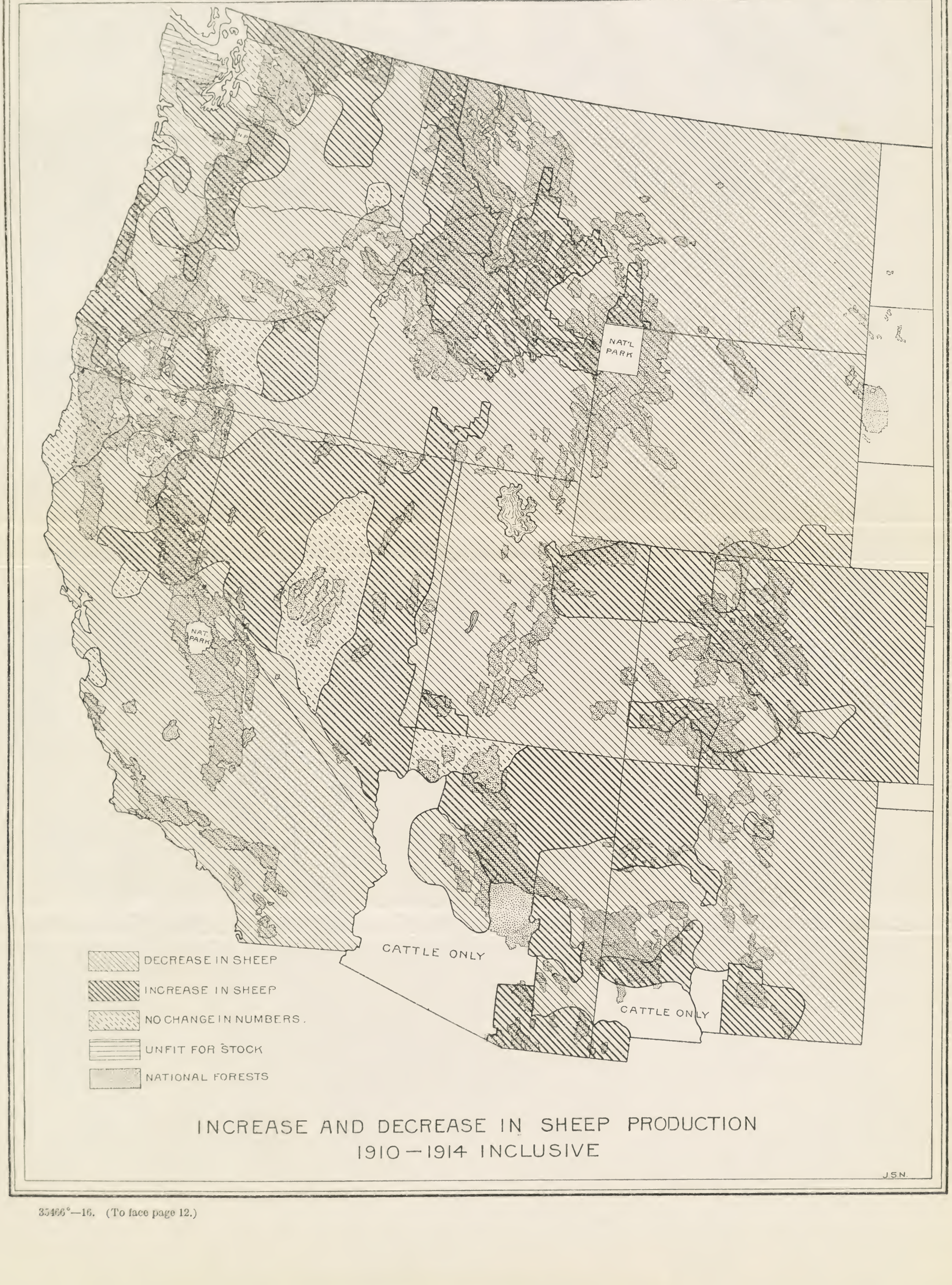
Without doubt this factor had some influence in bringing about the decrease in sheep up to and including 1913. Many men who had gone through several cycles of high and low prices for sheep and wool saw an opportunity to sell out at a good profit in 1912 and 1913. They did not want to risk losing this possible profit and the profit accumulated during several years in the sheep business through decrease in price of wool and mutton which they thought might follow. While it is true that many of the sales merely resulted in transfer of ownership and range rights, the sheep remaining on the range, a great many were placed on the market as mutton or feeders, and up to the time of this investigation (1914), had not been replaced. No measure in figures can be given for the decrease occasioned by this factor.

DIFFICULTY OF SECURING MONEY FOR PURCHASE OF BREEDING STOCK.

The credit factor has undoubtedly been influential in at least retarding the rate of restocking and building up the breeding herds following overselling when prices of cattle began to soar. Except intermittently for short periods, there has been little difficulty in securing money for the few months during which it is needed in the feeding business, but this short-term money is useless in the building up of breeding herds. It takes approximately three years to produce a marketable two-year-old steer, and the first crop of two-year-olds is hardly sufficient to warrant a forced payment of a loan on breeding cattle in three years. Five years will provide for the sale of three crops, and is about the minimum time a loan on breeding stock is of value. The difficulty of borrowing on a five-year loan and the comparative ease of securing the short-time money for feeders has resulted in retarding the development of breeding herds, and has increased the drain on "she stock" to make up the number of feeders needed.

INCREASE IN PRICE OF LAND AND DAIRY PRODUCTS.

Increase in price of land in some localities has made it difficult to produce beef at a profit, and as a consequence the rancher or farmer so situated has taken advantage of the high prices of dairy products and gone into dairying. It is believed that the aggregate effect of this factor, however, has been an increase in the total number of stock, including milch cows, rather than an appreciable decrease in beef production. Throughout the States in question the number of "dual purpose" cows used in dairying will probably about offset cases where beef cattle have been sold and dairy breeds purchased.



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may be considered negligible as a factor in the decreased production of live stock during this period.

On the other hand, high prices and general farm development have stimulated winter feeding, which has offset in part the loss to range use of the large acreage of land transformed into dry land grain farms. It is believed that increased winter feeding, coupled with increased fall and winter pasturing on alfalfa fields and other cultivated crops, is of sufficient importance to account for the 3 per cent difference between the 16 per cent reduction in the number of animals produced, as estimated from the extent of entry and settlement, and the 13 per cent decrease in live stock on the far western ranges since 1910, as estimated by the Department of Agriculture, and given on page 7.

By way of summary, it may then be said that the estimated 13 per cent decrease in live stock on far western ranges in 1914, as compared with 1910, can be attributed almost wholly to entry and settlement of public lands, which has resulted in the breaking up of ranges formerly used as breeding grounds for cattle and sheep.

POSSIBILITIES OF INCREASED PRODUCTION IN THE FUTURE.

With a minor number of local exceptions, the schedules show optimism, relative to future production of live stock in the States under consideration. They have been studied by counties and by States, and an attempt has been made to give in figures the estimated probable increase during the next 10 years. Table 5 gives these final estimates in percentages for sheep and cattle, and gives also the computed probable number of each class of stock.

TABLE 5.—*Estimated probable increase in live stock during the next 10 years, 1915 to 1924, inclusive, in the 11 far western States.*

State.	Cattle.		Sheep.	
	Per cent.	Number.	Per cent.	Number.
Arizona	15	112,236	10	134,970
California	8	115,920	7	143,811
Colorado	20	200,552	15	235,290
Idaho	20	64,240	10	265,570
Montana	45	283,878	10	322,860
Nevada	25	97,425	.....	.....
New Mexico	20	206,975	10	301,230
Oregon	20	91,560	5	114,207
Utah	25	77,950	6	94,273
Washington	20	36,288	15	74,256
Wyoming	20	146,800	2	84,193
Total	.....	1,433,824	.....	1,770,660

This total estimated probable increase is equivalent to 1,876,489 cow units on the basis of four sheep to one cow.

Comparing these figures with the estimated number of cow units at present (1914) (13,200,176, exclusive of milch cows), gives an estimated probable increase within 10 years of 14.2 per cent, made up largely of increase in cattle.

It must be admitted, of course, that some of these estimates may be wide of the mark, but they represent the opinions of a great many reporters. They are undoubtely low for the possible increase if the remaining public range should be placed under proper regulation, for the reason that the estimates are based largely on the assumption that no change, or only minor changes, will be made.

REASONS FOR EXPECTING THIS INCREASE.

The reasons advanced by stockmen and county correspondents in support of the estimated probable increase in live stock production within the next 10 years (1915–1924) may, with local exceptions, be grouped under the following headings:

(1) The number of live stock on farms and homesteads will greatly increase.

(2) Continued improvement in National Forest ranges and possible legislation favorable to development and better management of public-domain ranges will result in an increase in carrying capacity of the present range lands.

(3) Increased production on farms and homesteads, increased cost of production, high value of the individual animal, and general advancement in agriculture will result in greater care and economy in the utilization of range as well as forage grown on farms, with a consequent increase of production per unit of forage; and the same factors will result in a better grade of animals and a higher percentage of natural increase.

INCREASE OF LIVE STOCK ON FARMS AND HOMESTEADS.

Since it is estimated that the live stock on far western ranges has been decreased 16 per cent by entry and settlement of range lands since 1909; and, further, since approximately an additional 38½ million acres entered from 1905 to 1908, inclusive, as well as a large acreage of railroad and State lands which have passed into the hands of private individuals since 1905, are producing only a minimum of live stock, it is reasonable to expect that the bulk of increase in live stock production must come from increased production on these lands. The estimates of Table 5 were based largely on this expectation.

As already stated, the schedules show that not to exceed 30 per cent of the new settlers are producing live stock over and above the work

and milch animals actually necessary (milch cows necessary being perhaps one to three in most cases). Except for a minor number, the reports both from county correspondents and from stockmen say that the new settlers are turning to live stock production and that this movement will continue. The reasons given are: (1) They must raise live stock to make the lands pay; (2) high prices make live stock more profitable than grain farming; (3) the lands under discussion are within territory better adapted naturally to live stock production than to any other form of agriculture; (4) at best these lands have waste corners, stubble lands, and weeds on fallow lands, suitable for grazing, and live stock will help to keep lands clean; (5) the new farmers must eventually grow live stock or deplete the fertility of their lands. Many of the settlers realize that a change to diversified farming with live stock added will eventually be necessary; but, for several cogent reasons, this change will take place slowly. The change will be slightly accelerated by the present and anticipated comparatively high price of meat.

It will not require a large acreage of such lands to produce the necessary succulent winter forage for the few head of stock which can be pastured during summer, yet it is these small numbers grown by the large number of farmers which must eventually be relied upon to increase live stock production in proportion to increase in population. The fact that production of live stock on these dry-land farms involves perhaps 100,000,000 acres of lands in the 11 far western States alone—land the settlement of which has decreased live stock production 16 per cent in these States since 1909—makes it a problem of sufficient magnitude to justify the present efforts on the part of the States and the National Government to work out and demonstrate a profitable system of agriculture for these lands. Without doubt this problem offers the largest and most vital possibility of permanently increasing live stock production in the States under consideration.

INCREASE IN CARRYING CAPACITY OF RANGE LANDS.

Excepting a negligible few, the schedules state that the present range lands can be made to carry more stock. Only a minority give quantitative estimates of the possible increase. These estimates have been studied by county units and by States, and an average estimate of the possible increase in carrying capacity, expressed as a percentage, has been decided upon for each State. To avoid generalizations and to attempt a concrete representation of what the possibilities and limitations are, the estimates by States and the average for the 11 States are presented in Table 6. It should be remembered that they are merely estimates, based upon the information and

judgment of the investigators, supplemented by a large number of reports from stockmen and county correspondents. It is believed, however, that the figures are conservative.

TABLE 6.—*Estimated possible increase during the next 10 years (1915 to 1924, inclusive) in carrying capacity of present range lands, both on National Forests and outside, in the 11 far western States.*

State.	Possible increase.	State.	Possible increase.
	Per cent.		*Per cent.*
Arizona	20	Oregon	20
California	15	Utah	25
Colorado	25	Washington	20
Idaho	25	Wyoming	20
Montana	15		
Nevada	20	Average	20.1
New Mexico	25		

The means advocated for bringing about this possible increase in carrying capacity are uniform throughout the States, except for occasional local suggestions with a view to solving problems which exist in one locality or State and not in another. The various methods and suggestions given may be grouped under the following headings:

(1) Continuation of protection and regulation of grazing on National Forests.

(2) Grazing regulation of the remaining public-domain lands by some strong central authority; with few exceptions, Government regulation is advocated.

(3) Private ownership of the range lands.

(4) Water development.

(5) Reseeding of ranges.

(6) Improvement in methods of handling stock, including drift fences to control cattle, better methods of salting cattle, and improved methods of herding sheep.

(7) Opening new range by constructing trails, bridges, etc.

(8) Burning brush to clear land for grazing use.

(9) Destruction of prairie dogs.

NATIONAL FORESTS.

With the exception of certain timber ranges on the Pacific coast, where protection against fire has resulted in the growth of young forest and brush which shade out forage plants, the schedules show a general increase in carrying capacity of National Forest range, attributed to regulation, development, and improvement in methods of handling stock. The estimated increases, by States, vary from 15 to 30 per cent, with an average of about 20 per cent. Those re-

porting believe as a rule that the ranges will continue to improve in carrying capacity, primarily as the result of natural reseeding: by deferred grazing, and by more complete adoption of the improved methods advocated for handling stock. Undoubtedly the National Forest ranges as a whole will continue to increase in the number of stock carried for 10 years at least, owing mainly to more complete adoption of improved methods of managing both range and stock, and to some extent to the development of minor unused areas. On the other hand, a number of Forests of the Pacific Coast States will no more than maintain their present carrying capacity, because reforestation is shading out forage. It is difficult to say in the aggregate what the increase in number of stock carried during the next 10 years will be, but it is estimated that an increase of perhaps 15 per cent is possible in this time.

REGULATION OF REMAINING PUBLIC-DOMAIN LANDS.

Table 7 shows the July 1, 1914, statement of the General Land Office relative to the acreage of unappropriated and unreserved lands in the 11 far western States under discussion.

TABLE 7.—*Unappropriated and unreserved lands of the 11 far western States, July 1, 1914.*[1]

State.	Number of acres.	State.	Number of acres.
Arizona	36,958,749	Oregon	15,969,846
California	20,902,752	Utah	33,756,502
Colorado	18,899,441	Washington	1,799,774
Idaho	16,342,781	Wyoming	31,553,423
Montana	22,237,660		
Nevada	55,502,439	Total	284,028,210
New Mexico	30,104,843		

[1] Circular No. 335, G. L. O., U. S. D. I., July 1, 1914.

The schedules from stockmen and county correspondents vary widely in the estimates of the percentage of these remaining lands which are suitable for agricultural settlement under the present land laws and are not considered sufficiently reliable to include here. As a matter of interest, however, it may be stated that the average of the estimates places the remaining land suitable for agricultural settlement under present laws at approximately 12 per cent of the total 284,000,000 acres.

Assuming that 20 per cent is suitable for homestead entry and will be filed on within 10 years, there would remain in the neighborhood of 225,000,000 acres valuable primarily as range. With few local exceptions, the schedules indicate, and it is a fact beyond ques-

tion, that taken as a whole the annual forage crop on this vast acreage of land has deteriorated considerably from its original state. In many localities there has been little deterioration the last 10 years, but in such cases decrease in carrying capacity was brought about prior to 10 years ago. The quantitative estimates vary from 0 per cent in Washington, to approximately 50 per cent in Idaho, with Arizona and New Mexico at 30 per cent, Utah 20 per cent, and Nevada 20 per cent. To say that on the whole the annual crop of forage is 25 per cent less than it was originally is believed to be conservative.

The general opinion expressed in the schedules, especially from stockmen, is that the forage crop on these lands would come back to approximately its original condition if the lands were placed under regulation of some form so that overstocking and premature grazing could be prevented, and natural reseeding accomplished by deferred grazing or by temporary protection against grazing. The actual improvement in National Forest ranges in the last 10 years (estimated at 20 per cent) substantiates this belief and is referred to in many of the schedules. Considering the time necessary to actually place so large an area under administration and work out the proper management, it is doubtful if an average of 20 per cent increase in the forage crop could be brought about within 10 years, even if legislation providing for control were enacted at once; and when it is considered that much of the land is in small tracts, isolated from larger bodies by settlements within recent years, therefore difficult of administration, it is probable that an actual improvement in forage crop of 15 per cent would be the maximum that might be expected for the whole territory within 10 years.

There is another element in the situation, however, which would bring about further increase in the number of stock which could be grazed. At the present time, without control over these lands, it is impossible to adopt improved methods of handling the stock, and any possible construction of range improvements under existing legislation is merely an additional incentive for new men to crowd in and overstock the range. As a consequence, the only protection a stockman has is to keep his range eaten to the ground, and the only assurance that he will be able to secure the forage crop any one year is to graze it off before some one else does. The majority of the stockmen realize that such a practice works hardship on the range as well as the stock, but they are helpless to do otherwise.

With regulation would come water development, even distribution of stock, elimination of unnecessary handling, and adjustment of grazing season to avoid continuous premature grazing. These changes would mean conservatively an increase of 15 per cent in meat produc-

FIG. 1.—FLOCK CROSSING A SHEEP BRIDGE ON A NATIONAL FOREST.

Bridges on which sheep cross swift mountain streams have been built by Forest officers on many National Forests, thus saving long detours as well as making many ranges more accessible and useful.

FIG. 2.—DRIFT FENCE.

Drift fences are a great aid in handling range cattle. Forest officers counting cattle into Bridger National Forest, Wyoming, in the spring, through gate in drift fence on Forest boundary.

tion on these lands, due to improved methods of handling the stock under proper grazing regulation, which, added to 15 per cent increase due to improvement in the range, would mean a total of 30 per cent increase in live stock production in the next 10 years on public domain lands if they were placed under proper regulation. Eventually the increase would probably be nearer 50 per cent.

Not more than 30 per cent of the schedules received made suggestions as to the form of regulation which should be adopted or where the authority for administration should be placed. In probably 90 per cent of the cases where the form of control advisable was mentioned, regulation similar to that in force on National Forests was advocated.

WATER DEVELOPMENT.

For the range lands as a whole the schedules show water development to be the most needed improvement. Large areas in New Mexico, Arizona, southern Utah, and Nevada are at this time either not used because of lack of water or their use is uncertain, incomplete, and inefficient at best. Smaller local areas elsewhere throughout the public domain and National Forests are unused because of lack of water, and additional watering places on areas now in use would result in more efficient use. The water development necessary on the unused tracts is largely deep wells or expensive surface tanks, and water development on the smaller unused areas left will be expensive in proportion to the new range made available. For this reason the water development undertaken by stockmen will be very limited unless the individual is protected in the use of the range for a period long enough to justify the expenditure for development. Even then Government aid will be necessary, at least during the experimental stage, in perhaps one-half the localities.

RESEEDING OF RANGES.

Natural reseeding of the ranges is advocated in the majority of cases where this method of improvement is given as a possibility. A minority of the schedules advocate "seeding to some hardy forage plant." Experience gained from over 500 seeding tests with available cultivated forage plants on National Forests has shown that as a means of improving western ranges such seeding is of minor importance. On logged-off and cleared lands of the Pacific slope conditions are favorable to such improvement. In these cases the work can best be undertaken by private landowners. On the other hand, much can be accomplished by allowing the native vegetation to go to seed, although improvement by this means is dependent upon proper control of both range and stock.

IMPROVEMENT IN METHODS OF HANDLING STOCK.

The possible increase in carrying capacity through improvement in methods of handling stock has been partly discussed under regulation of public-domain range. It has been demonstrated on National Forest range that there is at least 15 per cent difference in carrying capacity of range under different methods of handling sheep. The new method advocated by the Forest Service involves considerable change from the old custom, and while the progress toward its adoption has been satisfactory, approximately 50 per cent of the sheep are still run under the old system. The adoption of this new method should be rapid on the public-domain range if regulated, but nothing can be done as long as the range is open to all comers. In the handling of range cattle, also, stockmen are beginning to appreciate fully the value of control by drift fences, proper salting, and adequate water supply. While great progress has been made along these lines on National Forests, the campaign for better handling is comparatively new, and there is yet much to be done. On the public domain nothing can be accomplished without legislation to control the lands and the stock and to authorize necessary improvements. With such legislation the problem is less difficult than on the more rugged ranges of the Forests.

OPENING NEW RANGES.

There is to-day comparatively little accessible range, with water available, which is not being used. In northern Idaho and northwestern Montana there is unused summer range for fully 400,000 sheep. In northern Washington there is still unused range, owing to lack of stock. In these localities the main reason for nonuse is the lack of live stock within reasonable distance of the available range, and the lack of winter range or hay ranches to provide for winter care of the stock. In recent years a portion of the available area has been used by sheep shipped in for summer grazing en route to fall market. Use of this character is uncertain, and it will take several years to work out the problem involved in a business on this basis; consequently complete utilization of these unused areas will be a matter of slow progress. In connection with these ranges considerable trail construction will be necessary, but this is being accomplished by the Forest Service as rapidly as demand for the range justifies. Aside from these areas there is but a negligible amount of actually unused range. There is, however, considerable range, especially on National Forests of Colorado and Montana, which is not stocked to full capacity, owing to lack of demand for the range. The partial shifting of the live stock business from a range basis to a farm basis will undoubtedly result in a demand for grazing privi-

ileges equal to the available range. Little, if anything, can be done to hasten this complete utilization. Available unused and partly used range elsewhere is limited largely to that discussed under the topic "Water development."

Summing up this question of unused range, it may be said that the increase in live stock production as a result of bringing into use hitherto unused range at most will result in an increase of between 1 and 2 per cent of the total range live stock in the States in question. To bring about full utilization will necessitate regulation of public domain lands, water development, and trail construction, and work on the part of officers administering grazing in the way of informing stockmen of the available range and encouraging its use.

BURNING BRUSH AND CLEARING LAND.

On many of the National Forests of the Pacific slope protection against fire is resulting in rapid reforestation. As the timber and brush become more dense the forage crop decreases. Schedules from a few stockmen advocate annual burning to keep down brush. This is clearly inadvisable, even should there be small areas where the benefits derived would more than offset the loss, for the reason that it would endanger larger areas where fire would mean a loss of timber out of all proportion to any benefits derived from improved grazing. The subject is mentioned only in order to account for all methods advocated for increasing the carrying capacity of the western ranges.

DESTRUCTION OF PRAIRIE DOGS AND OTHER RANGE-DESTROYING RODENTS.

Throughout Colorado, New Mexico, Arizona, southern Utah, and eastern Montana there is a vast acreage of range, amounting probably to a total of several million acres, which has been decreased in carrying capacity from 1 to 20 per cent by the destructive work of prairie dogs. For the last six years work in the extermination of prairie dogs has been carried on by the Biological Survey with cooperation from the Forest Service on lands within the National Forests. The result is that a number of Forests have been practically cleared of this range pest. To carry on similar extermination work on outside range will involve the treatment of adjoining private lands as well; consequently it is a big task and perhaps of doubtful advisability unless the lands are placed under regulated use so that the benefit to be derived will be a maximum, and so that individual owners will have a more personal interest in keeping the dogs out after the main work of extermination is done.

GRAZING LANDS ON INDIAN RESERVATIONS.

In addition to the grazing lands of the unappropriated and unallotted public domain and those within the National Forests there are 31,686,394 acres of grazing lands on the Indian reservations within the 11 States under consideration. On June 30, 1914, the records showed a total of 348,775 cattle, 306,733 horses and mules, and 2,178,510 sheep and goats on these lands. Considering one horse or mule the equivalent of one cow, and four sheep the equivalent of one cow, the total live stock is equivalent to 1,200,135 cow units on the 31,686,394 acres, or an average of 26.4 acres per cow unit. The average area necessary to support one cow as given in Table 3, page 8, is approximately 22 acres. It would seem therefore that the lands of the Indian reservations are about fully stocked, but that there may perhaps be a slight increase in numbers of stock in future, as it is believed that the grazing lands on the Indian reservations are above the average in carrying capacity.

INCREASED PRODUCTION DUE TO GREATER ECONOMY IN THE USE OF RANGE FORAGE AND HAY.

The possibility of improvement along this line was referred to by many of the men who submitted schedules. Just what will be possible or should be expected in the way of increase in numbers due to greater economy in the use of forage and greater attention so as to produce the maximum number on minimum forage is difficult to say. Undoubtedly, however, the increase in value of stock, increase in cost of production, scarcity of range, and general agricultural advancement will result in an increased effort to utilize waste areas and roughage which have heretofore received but little consideration. Further, it will result in greater attention to the protection of live stock against severe storms, as well as greater effort to avoid waste in feeding. The result can not but be increased production per unit of forage.

INCREASED MEAT PRODUCTION BY IMPROVEMENT IN GRADE OF LIVE STOCK.

Table 8 shows the average weight of a long 2-year-old steer by groups of States in which conditions are similar. These averages are based upon weights given in the individual schedules from stockmen.

TABLE 8.—*Average weight of a long 2-year-old steer.*

	Pounds.
Arizona and New Mexico	775
California, Oregon, and Washington	990
Idaho, Montana, and Wyoming	980
Colorado, Nevada, and Utah	910

The fact that the average weight of a long 2-year-old range-raised steer is as high as it is indicates that some effort has been made to improve the grade of the stock. While no figures are available to show what the average weight was 5 or 10 years ago, the investigators can say from rather wide personal knowledge of conditions in the past and those of to-day that the average grade of range stock has been appreciably improved. A study of the individual schedules received shows a wide variation in the weights given for different localities. For example, the minimum weight reported for California is 700 pounds for a long 2-year-old steer, the maximum 1,175; for Idaho a minimum of 900, and a maximum of 1,100; for Montana a minimum of 700 and a maximum of 1,100; for Nevada, a minimum of 600 and a maximum of 1,100; for New Mexico a minimum of 500 and a maximum of 950; and for Utah a minimum of 750 and a maximum of 1,000. Granting that this wide difference between maximum and minimum is not representative of any large number of stock, enough reports were received which approached the maximum and enough which approached the minimum given to bear out the statement that there is a marked variation in the grade of stock in different localities as well as on the same range. The practice of selling feeders as well as beef by weight rather than by the head has greatly increased and undoubtedly will become the general practice, for the reason that it is a more consistent and more reliable basis of purchase or sale from the standpoint of the grower, the feeder, and the banker. From the standpoint of the stock industry it is an incentive to the production of better stock. Stockmen everywhere are improving their herds and undoubtedly will continue to do so. Control of all range and stock under fence would accelerate progress along this line.

INCREASE IN CALF CROP.

Table 9 shows, by States, the average number of calves for each 100 cows, as well as the number of bulls for each 100 cows, as given by the schedules from stockmen.

TABLE 9.—*Average number of bulls for each 100 cows and average number of calves for each 100 cows.*

State.	Bulls.	Calves.	State.	Bulls.	Calves.
Arizona	6	57	New Mexico	5	66
California	3.73	73.55	Oregon	4.04	75.74
Colorado	4.16	69.3	Utah	4	69
Idaho	4	75	Washington	3.72	79.48
Montana	3.44	75.8	Wyoming	5.52	73.2
Nevada	4	70			

The main object of Table 9 is to show that the general average number of calves for each 100 cows is approximately 70, and that

there is a maximum difference of 22 calves per 100 cows between Arizona and Washington. Individual schedules show a difference as great as 40 calves per 100 cows, and undoubtedly there are many such cases. Individual schedules report an average calf crop of 90 per cent, which is rare under range conditions. Many, however, report 80 and 85 per cent, but the average is lowered by the great number of schedules which show from 60 to 75 per cent. As long as range was free and winter feeding at the minimum a small calf crop was not serious. The cost of caring for a cow during the year, however, is now so high that the burden of caring for one that does not raise a calf materially increases the cost of production, and might readily eat up all profit in the production of yearlings. For example, in Oregon, with a 75.74 per cent calf crop and 5½ per cent loss of calves, the cost of producing a yearling is about $31. If the calf crop were 85 per cent, the cost of producing a yearling would be approximately $28.

The fact that many individuals are actually getting an 80 to 90 per cent calf crop is an indication that it is not beyond possibility under range conditions, and it is believed that the general average can and will be increased 5 to 10 per cent within the next 10 years by increase in number of bulls, improvement in grade of bulls, better care of both cows and bulls, and more attention to the segregation of dry stock from breeding stock.

High cost of production and high value of the individual animal are the main factors which will work toward bringing about the necessary changes. Any agency engaged in a campaign for lower cost of production and increased production of meat animals, however, should not overlook the possible 10 per cent increase in calf crop and the possible improvement in grade of stock.

SUMMARY.

CHANGES IN NUMBER OF CATTLE AND SHEEP ON RANGES IN THE 11 FAR WESTERN STATES SINCE 1910.

(1) There is an estimated reduction of 859,120 cattle and 4,537,578 sheep in 1914, as compared with 1910. Considering four sheep as the equivalent of one cow, this means a reduction of approximately 13 per cent in live stock (cattle and sheep).

(2) The entry and settlement of approximately 85,500,000 acres of lands in these States since 1909 has resulted in a decrease of approximately 16 per cent in live stock production since 1910, due to the breaking up of ranges formerly used as breeding grounds for cattle and sheep.

(3) High prices and general farm development in the range region have resulted in increased winter feeding of range live stock, thereby reducing the amount of range necessary per animal, and

consequently in part offsetting the 16 per cent decrease due to settlement.

(4) Uncertainty as to future conditions, difficulty of securing money for purchase of breeding stock, increase in value of land and dairy products, improvement in grade and weight of animals at the expense of numbers, drought and severe winters, and range deterioration have had some effect in bringing about decreases in numbers during a part of the period 1910–1914, but, considering this period as a whole, these factors had only a small influence in the aggregate.

POSSIBILITIES OF INCREASED PRODUCTION IN THE FUTURE.

(1) The production of live stock in the 11 far western States will probably increase 15 per cent in the next 10 years, 1915 to 1924, inclusive, because—

(*a*) Settlers on approximately 100,000,000 acres of range lands settled since 1905 will turn to raising live stock.

(*b*) The carrying capacity of summer range within National Forests will increase probably 15 per cent, and winter feeding adjacent to National Forest ranges will probably increase accordingly.

(*c*) Better management of stock, both on farms and on the range, will result in greater economy in the use of forage and, consequently, will increase the number of stock produced with a given amount of forage.

The probable increase of 15 per cent in carrying capacity of the present National Forest ranges in the next 10 years, 1915 to 1924, inclusive, will be largely the result of complete adoption of improved methods of handling stock and of deferred grazing, supplemented by more complete utilization of range which is now only partly utilized or not utilized at all because of lack of water, trails, bridges, etc., or to lack of local demand for range. To bring about these changes will necessitate persistent effort on the part of the Forest Service to secure the adoption of improved methods of handling stock, a liberal policy relative to drift and division-fence construction, cooperation with stockmen in regard to water development, and construction of trails and bridges.

(2) There still remains a total of approximately 284,000,000 acres of unreserved and unallotted public lands within the 11 States referred to, of which about 250,000,000 acres are essentially grazing lands. Under adequate control, with development of water for stock, construction of sufficient fences, and other range improvements to secure efficient management of both stock and range, these lands would within 10 years probably carry 30 per cent more stock than at present. But without some form of control the best that can be hoped for is the maintenance of the present carrying capacity.

(3) By the use on the ranges of a higher grade and a greater number of bulls, the separation of breeding stock from dry stock, and better care and management of the breeding animals throughout the year, it should be possible to increase the number of calves 5 to 10 per cent and the average weight of a 2-year-old steer perhaps 30 pounds.

COST OF PRODUCTION AT PRESENT (JANUARY, 1915) UNDER WESTERN RANGE CONDITIONS.

CATTLE.

In order to determine approximately the cost of producing cattle with the limited time and machinery available, it was believed advisable to estimate the feed used at a fair market value in the vicinity. This eliminated the necessity of considering the money invested in farms, ranches, range improvements, and equipment, as consideration of such investments would necessitate consideration of all products, and the cost of their production, on all lands used in connection with the production of live stock. Therefore there may be a slight additional profit in the feed furnished and also in the labor of the owner's family or himself above the actual profit shown by the difference between the cost of producing an animal and its selling price.

The main data upon which the estimates of cost which follow are based were secured from representative stockmen in answer to a schedule of questions sent to them. (See Table 10.)

The answers received were studied by individual schedules, by small units of territory, and by States, with a view to eliminating figures which were, beyond doubt, either too high or too low. The accepted answers were then compiled by States. Table 10 shows the average figure for each question, by States.

For the purpose of contrast the average figures given in Table 10 were compared with individual schedules known by personal information of the investigators to be about right, and occasional slight changes were made before the figures were used in computing cost of production. Such changes, however, are called to attention wherever the item as corrected is used in the computations. With these figures as a basis and an added uniform charge of 25 cents per head for salt and 3 per cent for loss of bulls, the average cost of production for cattle has been computed for each State. For States where the cost of production on an area of any considerable size differs from the average, a supplemental statement of costs is given.

It was difficult to arrive at a satisfactory figure for the item of depreciation from the schedules submitted by stockmen. A large number of the stockmen did not figure depreciation in cows, asserting that after having raised several calves the cow is sold for beef at a

TABLE 10.—*Averages, by States, of answers from stockmen to questions 1 to 17, on the cost of producing cattle.*

State.	1	2		3	4	5	6	7	8	9	10			11	12	13	14		15	16	17
		a	b								a	b	c				a	b			
	Months.				*Months.*			*Per ct.*		*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Pounds.*	*Pounds.*			
Arizona	12.0	$1.26	$1.16					6.00	$82.00	57.00	8.30	4.40	6.40	6.00	12.70	9.90	774.0	935.0	$2.43	$2.02	$23.01
California	10.0	6.22	5.51	$11.83	2.00	$7.18	$9.32	3.73	94.75	73.55	6.76	4.15	4.12	4.95	17.22	8.10	968.2	1,141.6	2.94	2.12	19.19
Colorado	7.4	2.35	2.12	9.80	4.60	8.56	8.80	4.16	131.90	69.30	8.03	4.90	4.54	5.26	18.32	8.82	883.0	1,084.5	2.76	2.36	35.66
Idaho	7.5	2.25	2.15	8.35	4.00	8.50	8.00	4.00	100.00	75.00	7.00	4.00	3.00	12.00	16.00	10.00	1,000.0	1,200.0	2.95	2.00	30.00
Montana	8.0	3.97	3.07	9.02	4.00	8.04	9.20	3.44	138.00	75.80	7.04	3.87	2.74	4.74	17.50	9.69	991.0	1,211.0	3.87	2.63	29.89
Nevada	8.0	3.00	2.56	7.28	3.50	7.57	7.95	4.00	93.00	70.00	6.00	4.00	4.00	6.00	17.00	8.00	940.0	1,140.0	2.75	1.88	20.00
New Mexico	11.2	1.24	1.10	1.00	.20			5.00	83.00	66.00	10.60	5.60	5.80	5.80	15.40	10.20	725.0	934.0	2.77	4.62	28.00
Oregon	8.59	3.94	3.51	9.92	3.41	7.61	8.05	4.04	113.35	75.74	5.39	3.27	3.00	3.35	13.50	8.42	975.7	1,185.9	3.53	1.85	25.80
Utah	9.0	2.06	1.96	7.65	3.50	7.65	8.15	4.00	93.00	69.00	6.00	5.00	5.00	8.00	15.00	8.00	900.0	1,085.0	2.95	3.88	20.00
Washington	7.9	5.47	5.19	8.61	4.10	9.92	12.25	3.72	124.15	79.48	5.33	4.78	3.70	5.24	14.70	8.70	1,032.0	1,225.0	3.71	3.20	25.61
Wyoming:[1]																					
District 2	7.85	3.76	3.72	8.65	4.15	6.64	7.30	5.52	160.50	73.20	5.87	3.92	2.79	3.58	18.00	9.56	937.0	1,155.0	2.33	1.62½	30.42
District 4	7.0	3.14	1.89	9.33	5.00	8.33	9.75	4.00	132.00	83.00	7.00	3.00	3.00	7.00	12.00	9.00	1,075.0	1,300.0	1.87	2.29	32.00

[1] These are the district divisions of the Forest Service. District 4 covers the Teton and Wyoming National Forests south of Yellowstone Park and lying adjacent to the Idaho State line. District 2 covers the rest of the State.

SCHEDULE OF QUESTIONS SUBMITTED TO STOCKMEN.

1. How many months are your cattle run on the open range or in pasture?
2. What is the average cost to you per head for range and pasturage (for the time given under 1) for (a) a cow and calf; (b) dry stuff from (including) yearlings up?
3. What do you estimate the range, pasturage, and other feed costs you to raise a calf from birth to 12 months of age?
4. How many months each year do you feed your cattle hay or other farm crops?
5. What is the cost of this feed (not including labor for feeding) per head of stock from yearlings up per year, where the cattle are fed as stock cattle, not as beef?
6. What is the average cost per head for this winter feed, including the labor of feeding, in cases where feeding of stock cattle is contracted for by the head, the contractor to furnish hay and do the feeding?
7. How many bulls to the hundred cows do you use in your herd?
8. What is the average value of your bulls?
9. What is the average number of calves born for each hundred cows of breeding age?
10. How many cattle of all ages do you estimate you lose every year for each hundred head from disease, predatory animals, poison, and other causes (a) of calves up to 12 months old; (b) yearlings 12 months to 24 months old; (c) cattle over 24 months old.
11. Based on her value what per cent do you allow for the yearly depreciation of a range cow?
12. What is the average yearly per cent depreciation of bulls?
13. What is the average annual rate of interest charged in your vicinity for money loaned on cattle?
14. What is the average weight of (a) long 2-year-old steers sold direct from the range or pasture; (b) long 3-year-old steers sold direct from the range or pasture?
15. What is your estimate of the yearly labor cost per head for your cattle, excluding calves?
16. What is the rate of taxation per $100 in your county?
17. What is the per head valuation placed upon range cattle in your county for purposes of taxation?

price which eliminates depreciation. Other schedules based figures of depreciation on decrease in the value of the cow after 5 or 6 years of age. Still others gave actual figures for depreciation of cows without restriction as to age; the average of these figures, by States, varied from approximately 3 to 6 per cent. After a careful study of the whole situation as shown by the schedules and by personal investigations and knowledge, a uniform, arbitrary depreciation of 3 per cent for cows was decided upon for the States in question, and this figure is used in connection with the figures for other items in Table 10 in computing the cost of production.

The figures submitted by stockmen for the item of depreciation in bulls showed a variation similar to the variation in figures on the depreciation of cows. The average by States for this item varied from approximately 12 to 18 per cent. The uniform figure of $14\frac{2}{7}$ per cent was adopted for this item and was used in computing the cost of production for each State. This figure is based upon a period of seven years' service, or, say, four years' service, and at the end of the four years a sale value of 40 per cent of the original cost of the bull.

It is believed that this allowance for depreciation in cows and bulls, respectively, will adequately cover this item in the cost of production under the existing systems of management throughout the States in question.

Following is the cost of production, by States:

ARIZONA.

Cost of production is figured on the basis of 100 cows. Depreciation of cows is charged at 3 per cent, instead of 6 per cent, as given in Table 10 (see p. 27). Depreciation of bulls is placed at $14\frac{2}{7}$ per cent. Other items are as given in Table 10.

Cost of producing a calf to 12 months of age:		
Pasture for 100 cows for 12 months		$116.00
Loss of cows, 6.4 per cent, $50 valuation		320.00
Depreciation of cows, 3 per cent, $50 valuation		150.00
Bull service—		
Depreciation ($14\frac{2}{7}$ per cent, 6 bulls, $82 valuation)	$70.20	
Feed for 6 bulls	6.96	
Loss of bulls, 6 per cent	29.50	
		106.66
Labor, 100 cows and 6 bulls, $2.43 per head	257.50	
Salt, 100 cows and 6 bulls, $0.25 per head	26.50	
Taxes on $23.01 valuation, rate $2.02 per $100		49.30
Feed for calves, 53 head (57 per cent calf crop less 8 per cent loss), $0.10 per head		5.30
Total		1,031.26
Average cost per yearling (53 yearlings raised per 100 cows)		19.45

Cost of producing a 2-year-old steer:	
100 yearlings	$1,945.00
Pasture, 100 head, 12 months	116.00
Labor, 100 head, 12 months	243.00
Salt, 100 head, 12 months	25.00
Taxes, 100 head, 12 months	46.48
Total	2,375.48
Number raised to 2-year-olds (100 less 6 per cent), 94 head.	
Cost per head	25.27

It is doubtful whether in Arizona the average loss of stock over one year old reaches 6.4 per cent or calves 8 per cent, or whether labor on the average amounts to $2.43 per head. On the other hand, investments in land, water, improvements, and equipment must be taken care of in the feed and labor charge. As a whole, then, the above figures are perhaps slightly higher than the average actual cost.

The following statement is furnished by the manager of a large range outfit in central Arizona, and is fairly representative of the costs involved in handling cattle on the open range in herds of from 2,000 head up. These figures will apply to such sized outfits in Arizona, New Mexico, southern Colorado, and western Texas. The company reporting grazes approximately 17,000 head of high-grade cattle. Of these 17,000 head, 8,333 are bearing cows, 416 are bulls, the balance, about 8,250 head, are mixed young stock. The animals are grazed on open range the year round and no feeding is done. According to the books of the company the following are the items for running the outfit for the year 1913:

Sundries	$4,828.00
Labor	14,317.00
Supplies	5,753.00
Feed	23,870.00
Taxes	4,706.00
Total cash outlay	53,474.00
Cost per head based on actual running expenses	3.13

A depreciation charge of 5 per cent for cows and 15 per cent for bulls would run this total to $80,546, or a total cost of $4.74 per head. Dividing the 5,000 calves produced into this $80,546 cost and depreciation, gives a cost of $16.11 to produce one calf, but this, of course, makes them bear the burden of the whole herd, which is hardly fair.

The average annual branding for the company is 5,000 calves, or about a 60 per cent crop. The company pays for grazing fees on the National Forests 48 cents per head for the year-long period for a small number of their cattle, the majority of them being grazed on a near-by Indian reservation at a cost of $1.50 per head.[1] The com-

[1] For the year 1916 this has been raised to $2.40 per head.

pany's total investment for cattle, lands, saddle horses, improvements, etc., is approximately $500,000. All figures and estimates are taken exactly as given by the company without change.

Based upon the above data the cost to this company of raising a calf to 12 months of age is shown by the following figures, which are believed to be more truly representative of actual cost of production in Arizona than the first example of cost.

Arizona individual case.

First year:		
Pasture for 100 cows, 12 months		$225.00
Loss and depreciation, $50, 6 per cent, 100 cows		300.00
Bull service—		
Depreciation and loss, 5 bulls at $100 each, 15 per cent	$75.00	
Pasture 5 bulls 1 year	7.50	
		82.50
Labor, 105 head—100 cows, 5 bulls		105.00
Salt, 105 head at 25 cents		26.25
Taxes, 105 head at 28 cents		29.40
Miscellaneous costs, 105 head, 62 cents		65.10
Total		833.25
Number of yearlings raised per 100 cows, 54 head.		
Average cost per yearling		15.43
Second year:		
Cost of 100 yearlings		1,543.00
Feed for 100 yearlings		150.00
Salt for 100 yearlings		25.00
Labor		100.00
Taxes		28.00
Sundries and miscellaneous, 62 cents		62.00
Total		1,908.00
Number raised to 2-year-olds, 94 head,		
Average cost of one 2-year-old steer		20.30

At the present time (January, 1915) this company is selling its 2-year-old steers at from $35 to $40 per head.

In this statement the items of depreciation and loss have been allowed for liberally. The only item not counted is the one of depreciation on the company's improvements and on its investment in saddle horses, for which no data were secured. This company operates in a region where running expenses are somewhat higher than the average, and, while it maintains five bulls to the hundred cows, the extremely low calf crop is accounted for by the fact that the country is extremely rough and the cattle badly scattered. In all probability the addition of about two bulls to the hundred cows would add materially to the company's income.

CALIFORNIA.

In the following computation the figures of Table 10 are used, except that depreciation of cows is changed to 3 per cent; depreciation of bulls is placed at 14⅔ per cent; and hay feeding is allowed for one-fourth of the cattle. Cost is figured on the basis of 100 cows.

Cost of producing a calf to 12 months of age:		
Pasture for 100 cows, $5.51 per head		$551.00
Hay for 25 cows, $7.18 per head		179.50
Loss of cows, 4 per cent, at $50 valuation		200.00
Depreciation of cows, 3 per cent, $50 valuation		150.00
Bull service—		
Depreciation (14⅔ per cent, 4 bulls, $94.75 valuation)	$54.14	
Loss of bulls, 4 per cent	15.16	
Feed for bulls, $12.50 each	50.00	
		119.30
Labor, 100 cows and 4 bulls, $2.94 each		305.76
Salt, 100 cows and 4 bulls, $0.25 each		26.00
Taxes, 100 cows and 4 bulls		42.40
Feed for calves—69 calves per 100 cows (73.55 per cent calf crop, less 6.85 per cent loss)—		
Pasture, 70 cents each	$48.30	
Hay, $4 each	276.00	
		324.30
Total		1,898.26
Number of yearlings raised per 100 cows, 69 head.		
Average cost per yearling		27.51
Cost of producing a 2-year-old:		
Cost of 100 yearlings		2,751.00
Pasture, 100 head		551.00
Hay for 25 head, $7.18 each		179.50
Salt, 100 head, $0.25 each		25.00
Labor, 100 head, $2.94 each		294.00
Taxes		42.40
Total		3,842.90
Number raised to 2-year-olds, 96 head.		
Cost per 2-year-old		40.00

It is believed that these costs are approximately correct as an average for California.

COLORADO.

In the following computation the figures of Table 10 for loss are reduced to 3 per cent for cows, 4 per cent for yearlings, and 6 per cent for calves; depreciation on cows is reduced to 3 per cent; depreciation on bulls is placed at 14⅔ per cent; cost of hay for cows is reduced to $7 per head; feed for calves is placed at about one-half

that for a cow, and feed for a yearling at about three-fourths that for a cow.

Cost of producing a calf to 12 months of age:		
Pasture for 100 cows		$212.00
Hay for 100 cows		700.00
Loss of cows, 3 per cent, $50 valuation		150.00
Depreciation of cows, 3 per cent, $50 valuation		150.00
Bull service—		
Depreciation (4 bulls, $131 valuation)	$75.00	
Loss	15.72	
Feed, 4 bulls, $10 each	40.00	
		130.72
Labor, 104 head, $2.76 each		287.04
Salt, 104 head, $0.25 each		26.00
Taxes, 104 head		85.16
Feed for 65 calves (69.3 per cent calf crop, 6 per cent loss)—		
Pasture, 65 calves, $0.25 each	$16.25	
Hay, 65 calves, $3.50 each	227.50	
		243.75
Total		1,984.67
Number raised to yearlings, 65 head.		
Average cost per yearling		30.50
Cost of producing a 2-year-old:		
Cost of 100 yearlings		3,050.00
Pasture, 100 yearlings		212.00
Hay, 100 yearlings, $5.25 each		525.00
Salt, 100 yearlings, $0.25 each		25.00
Labor, 100 yearlings, $2.76 each		276.00
Taxes, 100 yearlings		84.16
Total		4,172.16
Number raised to 2-year-olds (4 per cent loss), 96 head.		
Average cost per 2-year-old		43.46

The figures given in Table 10 are undoubtedly too high, as an average for Colorado, to be consistent with those allowed for adjoining States. Therefore it is believed that the reductions made are justifiable, and that the costs given for a yearling and a 2-year-old are approximately correct.

IDAHO.

In the following computation the figures of Table 10 are used, except that depreciation of cows is placed at 3 per cent and of bulls at 14⅔ per cent; hay feed for a calf is placed at about one-half that for a cow, and for a yearling about three-fourths that for a cow, as given in Table 10.

Cost of producing a calf to 12 months of age:		
Pasture for 100 cows, $2.15 each		$215.00
Hay for 100 cows, $8.50 each		850.00
Loss of cows, 3 per cent, $50 valuation		150.00
Depreciation of cows, 3 per cent, $50 valuation		150.00
Bull service—		
Depreciation (14⅔ per cent, 4 bulls, $100 valuation)	$57.10	
Loss of bulls, 3 per cent, $100 valuation	12.00	
Feed for 4 bulls, $10.65 each	42.60	
		111.70
Labor, 100 cows and 4 bulls, $2.95 each		306.80
Salt, 100 cows and 4 bulls, $0.25 each		26.00
Taxes, 100 cows and 4 bulls		62.40
Feed for calves, 70 head (75 per cent calf crop, 7 per cent loss)—		
Pasture, 70 calves, $0.10 each	$7.00	
Hay feeding, 70 calves, $4.50 each	315.00	
		322.00
Total		2,193.90
Number raised to yearlings, 70 head.		
Average cost per yearling		31.34
Cost of producing a 2-year-old:		
Cost of 100 yearlings		3,134.00
Pasture for 100 yearlings, $2.15 each		215.00
Hay feeding, 100 yearlings, $6 each		600.00
Salt, 100 yearlings, $0.25 each		25.00
Labor, 100 yearlings, $2.95 each		295.00
Taxes, 100 yearlings		60.00
Total		4,329.00
Number raised to 2-year-olds (4 per cent loss), 96 head.		
Cost of producing a 2-year-old		45.10

These costs are believed to be approximately right for Idaho as a whole when market value of hay and labor is allowed.

MONTANA.

In the following computation the labor charge of Table 10 has been reduced to $3 per head; depreciation on cows to 3 per cent, and of bulls to 14⅔ per cent. Otherwise the computations are based upon costs as given in Table 10.

Cost of producing a calf to 12 months of age:		
Pasture for 100 cows, $3.07 each		$307.00
Feed for 100 cows, $8.04 each		804.00
Loss on 100 cows, 3 per cent, $50 valuation		150.00
Depreciation of 100 cows, 3 per cent, $50 valuation		150.00
Bull service—		
Depreciation (14⅔ per cent, 3.44 bulls, $138 valuation)	$67.80	
Loss of bulls, 3 per cent	14.24	
Feed of bulls, $11 each	40.00	
		122.04

Cost of producing a calf to 12 months of age—Continued.		
Labor, 100 cows and 4 bulls, $3 each		$312.00
Salt, 100 cows and 4 bulls, $0.25 each		26.00
Taxes, 100 cows and 4 bulls		81.32
Feed for calves, 71 head (75.8 per cent calf crop, 7 per cent loss)—		
Pasture for 71 calves, $0.90 each	$63.90	
Hay for 71 calves, $4.50 each	319.50	
		383.40
Total		2,335.76
Number raised to yearlings, 71 head.		
Average cost per yearling		32.89
Cost of producing a 2-year-old:		
Cost of 100 yearlings		3,289.00
Pasture, 100 yearlings, 8 months, $3.07 each		307.00
Hay, 100 yearlings, 4 months, $6 each		600.00
Salt, 100 yearlings, $0.25 each		25.00
Labor, 100 yearlings, $3 each		300.00
Taxes, 100 yearlings		81.32
Total		4,602.32
Number raised to 2-year-olds (4 per cent loss), 96 head.		
Average cost per 2-year-old		47.90

The above figures are probably a little too high for the cost of production in Montana as an average. The following statement of cost is for the eastern range section and is based upon the figures secured from a large outfit in this part of the State:

Montana individual case.

Cost of producing a calf to 12 months of age, eastern Montana:		
Pasture for 100 cows, 8 months		$450.00
Hay for 75 cows with calves, $7.50 each		562.00
Loss on 100 cows, $50 valuation		100.00
Depreciation on 100 cows, $50 valuation		150.00
Bull service—		
Deprecitaion of bulls	$85.00	
Loss of bulls	30.00	
Feed for bulls	48.00	
		163.00
Salt, 100 cows and 4 bulls, $0.25 each		26.00
Labor, 100 cows and 4 bulls, $2 each		208.00
Taxes, 100 cows and 4 bulls		90.00
Total		1,749.00
Number of yearlings raised per 100 cows, 65 head.		
Average cost per yearling		26.90

Cost of producing a 2-year-old:	
Cost of 100 yearlings	$2,690.00
Pasture, 100 yearlings	450.00
Hay fed only to cows with calves.	
Labor, 100 yearlings	200.00
Salt, 100 yearlings, $0.25 each	25.00
Taxes, 100 yearlings	90.00
Total	3,455.00
Number raised to 2-year-olds (3 per cent loss), 97 head.	
Average cost of 2-year-old	35.60

If for this large outfit in eastern Montana where only cows with calves are fed hay these estimates of cost are about right, as they appear to be, then the figures of the first computation, in which all stock are fed from three to four months, are but little too high. Probably for the entire State of Montana an average of $30 for the production of a yearling and $45 for the production of a 2-year-old is about right, considering, as we have in all computations, hay, pasture, and labor approximately at their value on the ground.

NEVADA.

In the following computation, loss of cows as given in Table 10 has been reduced to 3 per cent; depreciation of cows to 3 per cent; depreciation of bulls to 14⅔ per cent; hay for a calf to approximately one-half that for a cow; hay for a yearling to about three-fourths that for a cow; otherwise the items as given in Table 10 are used:

Cost of producing a calf to 12 months of age:		
Pasture for 100 cows, 8 months, $2.56 each		$256.00
Hay for 100 cows, 4 months, $7.57 each		757.00
Loss of cows, 3 per cent, $50 valuation		150.00
Depreciation of cows, 3 per cent, $50 valuation		150.00
Bull service—		
Depreciation (14⅔ per cent, 4 bulls, $93 valuation)	$53.10	
Loss, 3 per cent	11.26	
Feed, $10.13 each	40.52	
		104.88
Salt, 104 head, $0.25 each		26.00
Labor, 104 head, $2.75 each		286.00
Taxes, 104 head		39.10
Feed for 66 calves (70 per cent calf crop, 6 per cent loss)—		
Pasture, 66 calves, $0.44 each	29.00	
Hay, 66 calves, $4 each	264.00	
		293.00
Total		2,061.98
Number raised to yearlings, 66 head.		
Average cost per yearling		31.25

Cost of producing a 2-year-old:	
Cost of 100 yearlings	$3,125.00
Pasture, 100 yearlings, 8 months	256.00
Hay, 100 yearlings, 4 months, $5.50 each	550.00
Salt, 100 yearlings, $0.25 each	25.00
Labor, 100 yearlings, $2.75 each	275.00
Taxes, 100 yearlings	37.60
Total	4,268.60
Number raised to 2-year-olds (4 per cent loss), 96 head.	
Average cost per 2-year-old	44.46

The above costs are believed to be about correct on the basis of market value for hay and labor.

NEW MEXICO.

In the following computation the figures of Table 10 are used, except that depreciation of cows is changed to 3 per cent and depreciation of bulls is placed at 14⅔ per cent.

Cost of producing a calf to 12 months of age:		
Pasture for 100 cows, 12 months, $1.10 per head		$110.00
Loss of cows, 5.8 per cent, $50 valuation		290.00
Depreciation of cows, 3 per cent, $50 valuation		150.00
Bull service—		
Depreciation (14⅔ per cent, 5 bulls, $83 valuation)	$59.30	
Loss of bulls, 5.8 per cent	24.07	
Pasture, 5 bulls, $1.10 per annum	6.95	
		90.32
Labor, 100 cows and 5 bulls, $2.77 each		290.85
Salt, 100 cows and 5 bulls, $0.25 each		26.25
Taxes, 100 cows and 5 bulls		135.80
Feed for calves—		
60 calves per 100 cows (66 per cent calf crop, 10 per cent loss).		
Pasture, 60 calves, $0.14 each		8.40
Total		1,101.62
Number raised to yearlings, 60 head.		
Average cost per yearling		18.36
Cost of producing a 2-year-old:		
Cost of 100 yearlings		1,836.00
Pasture, 100 yearlings (12 months, $1.10 each)		110.00
Salt, 100 yearlings, $0.25 per head		25.00
Labor, 100 yearlings, $2.77 per head		277.00
Taxes, 100 yearlings		129.36
Total		2,377.36
Number raised to 2-year-olds (6 per cent loss), 94 head.		
Average cost of producing a 2-year-old		25.30

OREGON.

In the following computation the Table 10 figure on depreciation of cows has been reduced to 3 per cent; labor charge to $3; depreciation of bulls increased to 14⅔ per cent; feed for calf placed at about one-half that of a cow, and for a yearling about three-fourths that of a cow.

Cost of producing a calf to 12 months of age:		
Pasture for 100 cows		$351.00
Hay for 100 cows		761.00
Loss of cows, 3 per cent, $50 valuation		150.00
Depreciation of cows, 3 per cent, $50 valuation		150.00
Bull service—		
Depreciation (14⅔ per cent, 4 bulls, $113.35 valuation)	$64.75	
Loss of bulls, 3 per cent	13.60	
Feed for 4 bulls, $11.12 each	44.48	
		122.83
Salt, 104 head, $0.25 each		26.00
Labor, 104 head, $3 each		312.00
Taxes, 104 head		49.66
Feed for 72 calves (75.74 per cent calf crop, 5.39 per cent loss)—		
Pasture, 72 calves, $0.43 each	$30.96	
Hay, 72 calves, $4 each	288.00	
		318.96
Total		2,241.45
Number raised to yearlings, 72 head.		
Average cost per yearling		31.13
Cost of producing a 2-year-old:		
Cost of 100 yearlings		3,113.00
Pasture, 100 yearlings		351.00
Hay, 100 yearlings, $5.50 each		550.00
Salt, 100 yearlings, $0.25 each		25.00
Labor, 100 yearlings, $3 each		300.00
Taxes, 100 yearlings		47.75
Total		4,386.75
Number raised to 2-year-olds (4 per cent loss), 96 head.		
Cost of producing a 2-year-old		45.70

UTAH.

In the following computation the figure of Table 10 on loss of yearlings has been reduced to 4 per cent; loss of cows to 3 per cent; depreciation of cows to 3 per cent; depreciation of bulls, 14⅔ per cent; cost of hay for calf to one-half that for a cow; cost of hay for yearling to about three-fourths that for a cow. Aside from these changes, figures of Table 10 are used.

Cost of producing a calf to 12 months of age:		
Pasture for 100 cows, 9 months		$195.00
Hay for 100 cows, 3 months		765.00
Loss of cows, 3 per cent, $50 valuation		150.00
Depreciation of cows, 3 per cent, $50 valuation		150.00
Bull service—		
Depreciation (14⅔ per cent, 4 bulls, $93 valuation)	$53.10	
Loss, 3 per cent	11.10	
Feed, $9.61 each	38.44	
		102.64
Salt, 104 head, $0.25 each		26.00
Labor, 104 head, $2.95 each		306.80
Taxes, 104 head		80.70
Feed for 65 calves (69 per cent calf crop, 6 per cent loss)—		
Pasture, 65 calves, $0.10 each	$6.50	
Hay, 65 calves, $4 each	260.00	
		266.50
Total		2,042.64
Number raised to yearlings, 65 head.		
Average cost per yearling		31.43
Cost of producing a 2-year-old:		
Cost of 100 yearlings		3,143.00
Pasture, 100 yearlings, 9 months		196.00
Hay, 100 yearlings, 3 months, $5.50		550.00
Salt, 100 yearlings, $0.25 each		25.00
Labor, 100 yearlings, $2.95 each		295.00
Taxes, 100 yearlings		77.60
Total		4,286.60
Number raised to 2-year-olds (4 per cent loss), 96 head.		
Average cost of producing a 2-year-old		44.66

The foregoing costs are computed as an average for Utah as a State, and are believed to be approximately correct, although perhaps slightly high, for the reason that a large percentage of the stock is produced in southern Utah, where there is little feeding. The following statement shows approximately the cost of production in the southern and more purely range section of Utah:

Southern section of Utah.

Cost of producing a calf to 12 months of age:		
Cost of pasture, 100 cows, 12 months		$94.00
Hay for 25 cows, $8 per head		200.00
Loss of cows, 5½ per cent, $50 valuation		275.00
Depreciation, 3 per cent, $50 valuation		150.00
Bull service—		
Depreciation of bulls	$63.00	
Loss of bulls	18.94	
Feed for bulls	12.00	
		93.94

Cost of producing a calf to 12 months of age—Continued.	
Salt, 104 head, $0.26 each	$26.00
Labor, 104 head, $2.20 each	228.80
Taxes, 104 head	42.20
Feed for 61 calves (hay and pasture)	130.00
Total	1,239.94
Number raised to yearlings, 65 head.	
Average cost per yearling	19.08
Cost of producing a 2-year-old:	
Cost of 100 yearlings	1,908.00
Pasture, 100 yearlings, 12 months	94.00
Salt, 100 yearlings, $0.25 each	25.00
Labor, 100 yearlings, $2.20 each	220.00
Taxes, 100 yearlings	42.00
Total	2,289.00
Number raised to 2-year-olds (6 per cent loss), 94 head.	
Average cost of 2-year-old	24.35

The southern Utah conditions for which these costs are applicable are comparable to those of Arizona and New Mexico.

WASHINGTON.

In the following computation the Table 10 figures on cost of pasture are reduced to $4 per head; hay feeding to $9 per head; depreciation of cows to 3 per cent; depreciation of bulls to 14⅔ per cent; loss of cows to 3 per cent; feed for a calf to one-half that for a cow; feed for a yearling to about three-fourths that for a cow; labor charge to $3 per head. Otherwise, the Table 10 figures are used in the computation.

Cost of producing a calf to 12 months of age:		
Pasture for 100 cows, 8 months, $4 per head		$400.00
Hay for 100 cows, 4 months, $9 per head		900.00
Loss of cows, 3 per cent, $50 valuation		150.00
Depreciation of cows, 3 per cent, $50 valuation		150.00
Bull service—		
Depreciation (14⅔ per cent, 3.75 bulls, $124.15 valuation)	$66.50	
Loss of bulls, 3 per cent	13.96	
Feed for bulls	45.00	
		125.46
Salt, 104 head, $0.25 per head		26.00
Labor, 104 head, $3 per head		312.00
Taxes, 104 head		85.10

Cost of producing a calf to 12 months of age—Continued.		
Feed for 75 calves (79.48 per cent calf crop, 5⅓ per cent loss)—		
Pasture for 75 calves, $0.30 each	$22.50	
Hay for 75 calves, $4.50 each	337.50	
		$360.00
Total		2,508.56
Number raised to yearlings, 75 head.		
Average cost per yearling		33.45
Cost of producing a 2-year-old:		
Cost of 100 yearlings		3,345.00
Pasture, 100 yearlings, 8 months, $4 each		400.00
Hay, 100 yearlings, 4 months, $7 each		700.00
Salt, 100 yearlings, $0.25 each		25.00
Labor, 100 yearlings, $3 each		300.00
Taxes, 100 yearlings		81.92
Total		4,851.92
Number raised to 2-year-olds (4 per cent loss), 96 head.		
Average cost of producing a 2-year-old		50.54

The foregoing costs for Washington may be a little high for the average of what might be considered range production, owing to the fact that many of the schedules received apply to agricultural sections where hay and farm pasturage are high. To partly offset this fact, the cost of pasture and hay, as shown by the average of the reports in Table 10, was reduced. It is believed, however, that these items are still a little high, and therefore that the cost of production given is a trifle over the average for the State.

WYOMING.

In the following computation the figures of Table 10 for depreciation of cows is reduced to 3 per cent, depreciation of bulls is placed at 14⅔ per cent, cost of feed for a calf is placed at one-half that for a cow, and for a yearling three-fourths that for a cow. Otherwise, approximately the figures of Table 10 are used.

Cost of producing a calf to 12 months of age:		
Cost of pasturage for 100 cows, 7½ months		$372.00
Cost of hay for 100 cows, 4½ months		800.00
Loss of cows, 3 per cent, $50 valuation		150.00
Depreciation, 3 per cent, $50 valuation		150.00
Bull service—		
Depreciation (14⅔ per cent, 4½ bulls, $160 valuation)	$102.85	
Loss, 3 per cent	21.60	
Feed and pasture	52.74	
		177.19

Cost of producing a calf to 12 months of age—Continued.	
Labor, 104 head, $2.33 each	$242.33
Salt, 104 head, $0.25 each	26.00
Taxes, 104 head	62.40
Feed for 71 calves (75 per cent, 6 per cent loss)—	
Pasture for 71 calves included with cow.	
Hay for 71 calves, $4 each	284.00
Total	2,263.92
Number raised to yearlings, 71 head.	
Average cost of producing a yearling	31.88
Cost of producing a 2-year-old:	
Cost of 100 yearlings	3,188.00
Pasture, 100 yearlings, $3.72 each	372.00
Hay, 100 yearlings, $6 each	600.00
Salt, 100 yearlings, $0.25 each	25.00
Labor, 100 yearlings, $2.33 each	233.00
Taxes, 100 yearlings	60.00
Total	4,478.00
Number raised to 2-year-olds (3 per cent loss), 97 head.	
Average cost per 2-year-old	46.17

The following figures were furnished by one of the largest range cattlemen in the State of Wyoming. The cattle are grazed for four months upon one of the National Forests in that State, three months on the open public ranges (two in the spring and one in the fall), and about five months upon the owner's private fenced pastures, during which time they are fed hay when the snow covers the pastures, generally a period of from two to three months, depending upon the snowfall.

The cattle generally come from the Forest ranges fit for beef, the steers being shipped to eastern markets. None of these men figure on depreciation of cows, as they claim to sell them as beef animals for more than their value as cows.

Local prices for 2-year-old steers in the fall of 1914 averaged $60 to $65; fat cows, $50 to $55. Three bulls are used to the hundred cows. Bulls are valued at $200. The calf crop is only 50 per cent. The owner estimates that it costs him $25 to raise a yearling steer and $35 a 2-year-old steer.

His land is valued at from $15 to $25 per acre. Hay costs him in the stack about $1 a ton for the labor. Hay is valued at $5 per ton, and a ton is required to winter a cow. The calf crop should be much higher, as the range used is open and fairly smooth. Probably two more bulls to the hundred cows would greatly increase his calf crop.

Wyoming individual case.

First year:		
One cow—		
On range 7 months—		
Forest fees		$0.25
No cost open range.		
In pasture 5 months—		
Pasture values		.75
Hay feed, 1 ton		5.00
Salt		.25
Cost of feed, 12 months		6.25
Two cows, 12 months (on basis of 50 per cent calf crop)		12.50
Feed for calf in winter, one-half ton		2.50
Depreciation and loss, 6 per cent on $50 value, 2 cows		6.00
Labor costs, 2 cows		2.00
Bull service, valued at $200, 50 per cent crop, 3 to 100 cows—		
Feed, 3 bulls, 12 months	$18.00	
Taxes, $0.49	1.47	
Depreciation, 4 years' use	93.75	
Losses, 3 per cent	18.00	
Salt	.75	
	131.97	
Divide by 48 (4 per cent losses)		2.75
Cost to raise calf to 12 months		25.75
Second year:		
Feed, pasture, etc., 1 steer, 12 months		6.00
Taxes		.49
Losses, 3 per cent on $60 basis		1.80
Labor		1.00
Salt		.25
Total costs to raise 2-year-old steer		35.29

Owner estimates annual cost per animal about $7.50, divided as follows:

Labor	$1.00
Tax and salt	.75
Hay fed	5.00
Forest fees	.25
Miscellaneous items	.50
Total	7.50

These items cover all costs excepting deterioration of improvements, such as fences, tools, etc. The hay is taken at its full market value, which, of course, more than covers the question of an allowance for the land on which it was raised. Bull service is above the normal, owing to high price of bulls used and the very low calf crop. Owner markets about 1,200 fat cows and steers annually.

ALL STATES.

Table 11 shows the cost, by States, of producing a yearling and a 2-year-old, as developed in the preceding computations by States.

TABLE 11.—*Average cost, by States, of producing a yearling and a 2-year-old steer or heifer.*

State.	Yearling.	Two-year-old.
Arizona:		
Average figures of Table 10	$19.45	$25.27
Special report of large range outfit	15.43	20.30
California: Average figures of Table 10	27.51	40.00
Colorado: Average figures of Table 10	30.50	43.46
Idaho: Average figures of Table 10	31.34	45.10
Montana:		
Average figures of Table 10	32.89	47.90
Special report for eastern Montana	26.90	35.60
Nevada: Average figures of Table 10	31.25	44.46
New Mexico: Average figures of Table 10	18.36	25.30
Oregon: Average figures of Table 10	31.13	45.70
Utah:		
Average figures of Table 10	31.43	44.66
Schedules in southern Utah only	19.08	24.35
Washington: Average figures of Table 10	33.45	50.54
Wyoming:		
Average figures of Table 10	31.88	46.17
Special report of large outfit	25.75	35.29

At first glance the cost figures of Table 11 may appear much too high. It should be remembered, however, that they are based upon approximate market values for hay and pasture, in order to avoid consideration of investment in lands. Also, the labor charge included is sufficient to give the owner a fair compensation for the care of his stock, and loss as well as depreciation is taken care of. The difference between the cost of producing a steer as shown by Table 11 and the price the animal brings on the market is therefore a net interest-profit on money invested. By this method of computation the owner is given a profit on the hay and pasture produced on his farm or ranch, which he might not get if live stock were not produced, and therefore the net profit in production is really greater than is shown above in Table 11.

Granting that the costs given are a trifle high, it is believed that the man who is urged to substitute cattle production for other forms of agriculture in sections where it is necessary to feed hay to all stock for from three to five months each year should figure on approximately $30 as the cost of producing a good yearling, and $45 for producing a 2-year-old, under the present efficiency of the western stock industry. By raising 80 to 85 yearlings instead of 70 to 75 per 100 cows, and by decreasing the 3 to 4 per cent loss in cows and yearlings, these costs could be reduced to about $25 for a yearling and $40 for a 2-year-old, and still give adequate compensation for feed and labor.

SHEEP.

The report of the United States Tariff Board, appointed by President Taft,[1] on the entire subject of wool production in the United States covers sheep production so fully and carefully that, excepting to revise the figures where that seems necessary in order to bring them down to the year 1914, the securing of additional data on the cost of producing mutton was not deemed advisable. The investigations of the Tariff Board were carried on during the summer of 1911, and the few changes which in the opinion of the investigators have taken place since that report was published will receive due weight in considering the matter. The work of the Tariff Board covered the same group of States as are now under consideration, and in compiling the data secured these States were divided into three separate groups, in each of which the conditions under which sheep were handled were so uniform as to make this plan a satisfactory one. These groups were as follows: First, the State of California, in which conditions were not comparable to those found in any other of the western sheep-raising States; second, the southwestern group, consisting of Arizona, Colorado, and New Mexico; third, the northwestern group, consisting of Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming.

CALIFORNIA.

In the State of California conditions are somewhat different from those found in the rest of the States. Excepting for the feed secured upon the various National Forests, a majority of the sheep in the State are grazed upon privately owned lands, which naturally adds to the cost of feed. The annual cost of feed for one sheep in the State of California was found by the Tariff Board to be 81 cents, which cost is exceeded in only one other State in the sheep-raising regions, namely, Idaho, where the annual cost was 96 cents. In California comparatively little winter hay feeding is done, the sheep being grazed throughout the summer months in the high mountain regions, from which they drop into the foothill pastures and stubble fields, where they are wintered, returning to the National Forest ranges in the spring. Where the owners lease land for grazing purposes the prices paid are rather high, but the feed secured is unusually good, especially in the wheat-growing regions, where, after the crop is taken from the lands, a heavy growth of weeds and vines follows, furnishing a very high-class sheep feed. California is also somewhat different from the rest of the States in that on account of winter rains and brushy ranges many of the sheep are sheared twice a year, although this practice is growing less every year. This adds to the labor cost and somewhat reduces the wool values.

[1] Senate Document No. 342, 62d Cong., 2d sess.

At one time California was a large sheep-raising State. In 1880 there were more than 7,500,000 sheep within the State lines. The number has steadily decreased, however, until on January 1, 1915, there were but 2,500,000 sheep within the State.[1] A large number of the California sheep are of the mutton breeds, the owners having found the raising of lambs and heavy mutton sheep for their markets a profitable business. The per capita charge for labor in California is lower than in the other two groups, being 55 cents per head, which includes shearing. The amount of money invested in buildings and improvements on the lands of the sheep owners equals 79 cents per head, while the miscellaneous cost—selling, provisions, dipping, ram charges, and items of that class—equals 99 cents per head. The total annual expense chargeable against one sheep in the State amounts to $2.35, which amount should be increased somewhat, owing to the fact that since the report of the Tariff Board was made the cost of labor and several of the miscellaneous expenses have increased somewhat. In all probability if the annual cost of raising one sheep was $2.35 in the year 1911, it was at least $2.50 in the year 1914. This amount includes liberal allowances for losses and depreciation on both stock and equipment.

The annual percentage of increase is extremely high in California, being exceeded in only two other States in the Union, namely, Oregon and Washington. The increase in California amounts to 76.4 per cent. According to the report of the Tariff Board, the average wool clip for the State is 9.1 pounds, which for the year 1914 averaged for the State 14½ cents per pound. This would indicate that each ewe brought to her owner an average of $1.32 per head for the wool. On the basis of a 76.4 per cent lamb crop, deducting this wool crop from the cost of raising the lamb, we find that the cost to the California sheepman of producing one lamb is approximately $1.55. The average selling price of California lambs in the fall of 1914 was $4 per head. This price, however, represents the "tops," and in all fairness this average should be somewhat reduced to cover the percentage of "cull" lambs found in every band. It is believed that a reduction of 20 per cent should be made to cover this item, which brings the average price received per lamb down to $3.20.[2]

When the present report was made (January, 1915) ewes were valued in this group (California) at approximately $6 per head, and the total investment in sheep, rams, equipment, lands, and im-

[1] Farmers' Bulletin 651, February 6, 1915.

[2] In these and the following sheep figures it should be understood that the Tariff Board covered in their cost estimates all the charges herein enumerated, but did not allow interest on the investment. Investments in lands used in connection with the grazing and feeding of the sheep were covered by allowing the full market value of the feed produced and fed to the sheep.

provement equaled $10 for each ewe. Upon this basis, the cost of raising one lamb in this group will work out about as follows:

Cost of producing one lamb (California group).

Cost of running 100 ewes, at $2.50 each	$250.00
Deduct value of wool sold	131.95
Net cost of producing 76 lambs	118.05
Cost of producing one lamb equals $118.05 divided by 76 (the number produced by 100 ewes)	1.55

SOUTHWESTERN GROUP.

In the States of Arizona, Colorado, and New Mexico the conditions are somewhat different from those in all the other sheep-raising States. Here very little private land is used by the sheepmen, the majority of them either securing their range upon the National Forests in the summer and the open public lands in winter or grazing them throughout the entire year on the open public lands. Hence the cost of feed for this group is very low, being but 20 cents per head for the year.

The yearly labor costs average 61 cents per head, which includes shearing. This is somewhat higher than in the State of California, owing to the fact that lambing operations and the practice of herding during the entire year require the handling of the sheep in somewhat smaller bands, which necessitates more herders.

The average number of sheep to each 12-month employee in this group of States is 784 head, whereas in California each yearlong employee takes care of 1,225 head.

The miscellaneous costs, which include provisions, losses, depreciation, ram charges, etc., equal 95 cents per head, which is lower than in either of the other groups. The per capita value of the improvements and buildings on land owned by the sheepmen is only 59 cents, owing to the small investment in lands and improvements by the sheepmen of this region. The percentage of increase is only 59.6.

The total yearlong expense of running one sheep, as ascertained by the Tariff Board for this group, is $1.76. Since 1911 there has been a considerable increase in wages and cost of provisions in the States in this group, and also, in order to protect themselves, many of the sheepmen concerned have found it necessary to purchase lands upon which to winter their sheep, which has added to the per capita cost. In all probability, at the present time the annual cost of running one sheep in this group is not far from $2 per head. The average shearing for this group is 6.8 pounds per head, while the average

selling price for 1914 was 14.3 cents per pound. A large majority of the sheep ranged in this region are of the Merino blood, although in recent years rams of the mutton type have been introduced in some sections. It is, however, a region best suited to the production of Merinos rather than the open wool type of sheep. Based upon these figures, it is apparent that the income from the sale of wool from one ewe brought to her owner an average of 97 cents per head. On the basis of a 59.6 per cent lamb crop, and deducting this wool crop from the cost of raising the lamb, we find that the cost to the southwestern sheepman for producing one lamb is about $1.71. The average price received for southwestern lambs in the fall of 1914 was $3.27. Including prices received for "culls," this average should be reduced to about $2.80.

When the present report was made (January, 1915) the value of range sheep in this group was approximately $4.50 per head and the total investment (sheep, rams, equipment, lands, and improvements) equaled $6.50 per ewe. (See footnote, p. 45.) Upon the foregoing basis the cost of raising one lamb in this group will work out about as follows:

Cost of producing lambs (southwestern group).

Cost of running 100 ewes, at $2 each	$200.00
Deduct value of wool sold (delivered at nearest railroad shipping point)	97.24
Net cost of running ewes	102.76

With an average of 60 lambs raised to each 100 ewes, the cost of producing one lamb is $102.76 divided by 60, which equals $1.71.

NORTHWESTERN GROUP.

This group covers the States of Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming. In these States the majority of the lambs raised are of the mutton type, the ewes being of Merino foundation.

The average weight of fleece is 7.4 pounds, with an average selling price in the region for the year 1914 of 15 cents per pound.

The labor cost in this region is higher than in any of the other groups, being 65 cents per head, while the cost of feed, 55 cents per head, is somewhat less than in the State of California. The miscellaneous cost, which includes provisions, losses, depreciation, etc., is $1.05 per head. In this group the sheepmen have several items of expense not found in other regions, which swell their miscellaneous costs considerably. The investment in buildings and improvements is extremely high in this region, being $1.05 per head, which is due to the fact that on account of the extremely cold winters and often backward springs the majority of the sheepmen have found it neces-

sary to provide themselves with lambing sheds, feeding pens, and other equipment of this kind which is not required in either of the other groups, and adds materially to the cost of operation.

The total expense for running one sheep one year in this region in 1911 was $2.25. As in the other groups, it is certain that the cost of labor and provisions is now (January, 1915) somewhat higher than at the time the Tariff Board investigated the industry, although as against this the cost of leased lands for sheep-grazing purposes as well as hay for winter-feeding purposes has, owing to certain peculiar factors, been slightly reduced. If the average cost of running one sheep in these States in 1911 was $2.25, it is probable that at the present time the per capita cost is approximately $2.40.

In this group the number of sheep which one yearlong man can take care of is higher than the other groups, being 1,334 head. Were it not for this increased number of sheep for each man, the per capita cost in this region would be considerably higher than it is.

Owing to the care which is given the sheep in this region during the lambing period, the lamb crop is much higher than elsewhere in the West, excepting in the State of California. The average for the group is 70.9 per cent. The average price received for lambs produced in this region in the fall of 1914 was about $3.85 per head. This average included both "tops" and "culls."

When the present report was made (January, 1915) the value of range sheep in this group was approximately $5, and the total investment in sheep, rams, equipment, lands, improvements, etc., equaled $12 per ewe. Upon the foregoing basis the cost of raising one lamb in this group will work out about as follows:

Cost of producing lambs (northwestern group).

Cost of running 100 ewes, at $2.40 each	$240.00
Deduct value of wool sold from 100 ewes	111.00
Net cost of producing 71 lambs	129.00
Cost of producing one lamb ($129 divided by 71, the number of lambs produced by 100 ewes)	1.82

SUMMARY.

CATTLE.

In arriving at cost of production, market value was charged for all feeds used, and a liberal charge was allowed for cost of handling the stock, in order to take care of the items of cost for money invested in land, water, improvement, and equipment used in connection with the production of live stock.

Liberal charges were allowed also for bull service, depreciation of cows, loss of cows at market value, and other natural losses. A charge for taxes at the average rate for the State was included.

FIG. 1.—SHEEP HERDED AND GRAZED UNDER THE "MASS" METHOD.

FIG. 2.—SHEEP HERDED AND GRAZED UNDER THE "OPEN" OR IMPROVED METHOD.

Through improved methods of handling sheep the carrying capacity of the ranges can be greatly increased.

On this basis the cost arrived at for the production of yearlings in Arizona from average figures given is $19.45, and from data furnished by one large outfit, $15.43; for California, $27.51; for Colorado, $30.47; for Idaho, $31.37; for Montana, $32.89 in the main feeding sections and $26.40 in the range section of eastern Montana; for Nevada, $31.25; for New Mexico, $18.30; for Oregon, $31.13; for Utah, $31.46 in the feeding sections and $19.08 for the range section of southern Utah; for Washington, $33.45; for Wyoming, $31.88, average figures, and from special figures furnished by one large outfit, $25.75.

The cost arrived at for the production of a 2-year-old in Arizona is $25.25 from average figures, and $20.30 from special data furnished by one large outfit; for California, $40; for Colorado, $43.31; for Idaho, $45.12; for Montana, $47.90 from average figures, and $35.10 for the range section in eastern Montana; for Nevada, $44.46; for New Mexico, $25.85; for Oregon, $45.70; for Utah, $44.68 for the feeding sections, $24.35 for southern Utah; for Washington, $50.54; for Wyoming, average $46.18, and from a special report of a large outfit, $35.29.

These figures may appear too high, but it should be remembered that they include reasonable profit on farm or ranch products used, reasonable compensation to the owner for looking after his stock, and liberal allowance for loss, depreciation, bull service, and taxes. The net balance between cost of production and sale price represents net interest-profit on money invested in the breeding stock. Granting that the costs given are conservatively high, it is believed that for sections of the West where winter feeding is practiced the man who contemplates substituting live stock for other forms of agriculture should figure on a cost of approximately $30 for the production of a good yearling, and $45 for the production of a good long 2-year-old—this cost to include labor, market value of feeds, taxes, loss, bull service, and any depreciation of breeding stock. In sections of these same States where only a part of the stock is fed in winter the cost of producing a yearling may be set at approximately $25, and of a 2-year-old at $35. In the range sections of the Southwest the cost of producing a yearling may be set at $15 to $19, varying greatly with the number of calves per 100 cows, and the cost of producing a long 2-year-old at about $20 to $25.

The average weight given for a 2-year-old steer in the feeding sections is 960 pounds. At $45 as the cost of production, the cost per pound is about 4.6 cents. For Arizona and New Mexico the average weight of a 2-year-old steer is given as 775 pounds. At $25 for production the cost per pound is a little over 3.2 cents. For the Southwest, hazard due to the exceptional loss in time of prolonged drought is not fully covered in the above costs.

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SHEEP.

The report of the Tariff Board on the cost of raising sheep was so complete that it was deemed unnecessary to make a duplicate study. The Tariff Board figures, with such modification as seems necessary to bring them down to 1914, are therefore used.

For California the annual cost of maintaining one sheep is given by the Tariff Board, for 1911, as $2.35. It is believed that this figure should be increased to $2.50 to cover increases in labor and miscellaneous costs since 1911. Using this figure and including other items as given in the Tariff Board report, the cost of producing a lamb in California is $1.55.

In the States of Arizona, Colorado, and New Mexico the year-long expense for running one sheep is given by the Tariff Board report as $1.76. Increase in cost of running sheep since 1911 justified an increase of this item to $2. Using this figure with other items as given by the Tariff Board report, the cost of producing a lamb in these States is $1.71.

In the northwestern group of States—Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming—the cost of running one sheep for one year, it is believed, has advanced from $2.25, as given by the Tariff Board for 1911, to about $2.40 for 1914. On this basis the cost of producing a lamb in this group of States in 1914 is $1.82.

The foregoing figures make a liberal allowance to cover loss and depreciation and to provide for interest on capital invested in land, improvements, and equipment and include wool at market price. Consequently, the net interest-profit is the difference between cost of production and selling price.

DIGEST, BY STATES, OF THE SCHEDULES RECEIVED FROM STOCKMEN THROUGH THE FOREST SERVICE AND FROM COUNTY CORRESPONDENTS THROUGH THE BUREAU OF CROP ESTIMATES.

The answers received in the individual schedules from stockmen and county correspondents were first tabulated and then studied by States. The following pages give a digest of the information, comments, and conclusions, by States. They are here appended for reference in case of questions relative to the general discussion and conclusions given in the foregoing report or when more detailed information is desired relative to any section of the territory under consideration. These schedules were also supplemented by many full and careful reports from Forest officers in close touch with the range situation.

The figures on total live stock in 1910 and 1914 are taken from the "Agricultural Outlook," issued by the United States Department of

Agriculture, February 7, 1914 (Farmers' Bulletin 575). Figures on unreserved and unappropriated public lands are taken from Circular No. 335, General Land Office, July 1, 1914.

ARIZONA.

Cattle in Arizona:	
1910 census	825,000
January 1, 1914	776,000
Decrease per cent	6
Sheep in Arizona:	
1910 census	1,227,000
January 1, 1914	1,601,000
Increase per cent	30
Unreserved and unappropriated public land in State July 1, 1914 acres	36,958,749

CHANGE IN LIVE STOCK ON THE RANGE SINCE 1910.

Cattle.—Taking the State as a whole, the cattle seem to have decreased by about 49,000 head, a loss of approximately 6 per cent since 1910. The major portion of this loss appears to have been in the southern tier of counties, where, in one of the most densely stocked areas, the Sulphur Spring and San Simon Valleys, the settlement of the open ranges during the last few years has made such serious inroads upon the range as practically to drive out of business several of the larger companies and greatly to restrict open range cattle operations. The only part of the State showing an actual increase in numbers is in the northern central part in Coconino County, where, owing to improved range conditions, with a considerable change in holdings from sheep to cattle, an increase of between 7 and 10 per cent in the number of cattle is noted. In these changes the figures submitted by the stockmen and those from the county schedules, with a few exceptions, are fairly comparable.

Sheep.—The 30 per cent increase in the number of sheep in the State shown by the census reports does not seem to be borne out by the schedules which have been received in this investigation. There has undoubtedly been an increase in the number of sheep in the extreme northeastern part of the State, covering the Navajo Indian Reservation and the northern parts of Navajo and Apache Counties; also, in the north-central part, the county of Coconino shows an increased number of sheep. The average increase, however, for these areas as shown by our schedules indicates that the increase is under 10 per cent, which, from personal observation and rather intimate knowledge of the conditions existing, is believed to be more nearly correct than the 30 per cent increase shown by the census reports.

Homesteaders.—Taking the State as a whole the settlement of the land by homesteaders has reduced the available grazing areas about 6.7 per cent, according to the figures submitted by the stockmen, while those from the county correspondents are exactly double that, or 13.4 per cent. This settlement is scattered very generally over the entire State, but by far the largest has been in the county of Cochise in the San Simon and Sulphur Spring Valleys heretofore mentioned. The figures indicate that as a result of this agricultural settlement the number of cattle has been decreased about 4.2 per cent, and the number of sheep about 9.2 per cent. This decrease reported in the number of sheep is doubted, for the reason that in the regions where agricultural settlement has been the heaviest no sheep grazing has ever been carried on, and in the actual sheep grazing counties what little agricultural development there has been has undoubtedly increased rather than decreased the grazing of sheep in that vicinity.

Change from beef to dairy stock.—There has been no noticeable change along these lines anywhere in the State. In the Salt River Valley, owing to the erection of a number of new creameries, the dairy business has made some advances, but it has been a direct increase rather than a transfer from beef to dairy stock.

Deterioration of the range.—Broadly speaking, there has been no very decided further deterioration of the range during the last 10 years. As a general thing, the schedules indicate no particular change, and some report positive improvement. Almost universally the schedules indicate that the present carrying capacity of all the ranges could be greatly improved through some governmental control of the ranges which would bring about regulated grazing and an improvement or development in water supply. Almost uniformly the schedules indicate that on the ranges within the National Forests the improvement in grazing conditions has been marked and their carrying capacity greatly increased, while their use by the various stockmen is far more satisfactory than under the old conditions. Throughout the State the ranges are used the year round, little or no feeding being done excepting for very short periods in the spring. If the cattle are extremely weak and hay can be obtained at reasonable prices a few of the cows are fed a little hay to carry them through the dangerous period of the season. This feeding, however, is not at all general and probably does not cover more than 1 per cent of the total.

Better grade of stock.—In the last 10 years there has been a steady improvement in the class of live stock on the ranges in Arizona This is especially true of the cattle, a considerable advance having

been made in the class of bulls used upon the range. There is, however, still room for improvement along this line all over the State. The average value of the bulls used is $82 per head, the lowest in all the 11 States studied. If Arizona would prohibit the use of other than pure-bred or registered bulls on the ranges an almost immediate improvement in the weight and value of range cattle would be noticed.

Weight of steers.—The average weight of 2-year-old steers sold direct from the range or pastures is 774 pounds; for 3-year-old steers, 935 pounds. While these average weights are materially lower than the weights reported in some of the northwestern States, it should be remembered that the steers shipped from fully 75 per cent of the Arizona ranges are sold in the early spring as feeders to be sent to the northern ranges and the corn-belt farms for fattening. The majority of the steers shipped from the Forest ranges in the northern part of the State are generally sent direct to market for immediate slaughter, and the Arizona weights under these conditions compare favorably with the weights of the same class of animals shipped from the northern ranges.

POSSIBILITY OF INCREASING NUMBER OF STOCK IN THE STATE.

Public ranges.—Practically all the available range in Arizona is at present fully occupied by live stock of one class or the other. This includes the National Forests, the open ranges, and the Indian reservations. The area necessary for one cow for 12 months is estimated at 34.8 acres by the Forest Service reports, while the figures of the Bureau of Crop Estimates are 21.4. Taking the State as a whole, 35 acres to one cow is about right.

In the southwestern and western portions of the State there are large areas which under some plan of Government control would carry a very considerable number of cattle if some development of water for stock purposes could be secured. At present, however, these ranges are practically unused, owing to the fact that there is little or no incentive to the individual stockman to develop water at a very considerable expense when he has no guaranty that the ranges about the watering place will be occupied by only his own stock. Practically every individual reporting on the possibility of increase states that the range in his vicinity could be made to carry more stock if it were placed under Government control, many of them referring to the Forest Service methods as being satisfactory and adaptable to these areas. One well-known stockman referring to this matter states that the only way he can protect his range from the encroachments of migratory herds, both cattle and sheep, is to

keep it practically overgrazed all the time so that there will be nothing on the range which will attract the stock of other persons. None of the schedules received make any estimate as to the probable percentage of increase which these changes might bring about, but it is safe to estimate that taking the State as a whole the number of cattle in Arizona could be increased under some form of range control not less than 30 per cent, while an increase of perhaps 10 per cent in the sheep would be about all that could be expected for that class of stock.

Increase from farms and new settlers.—The opinion expressed in a majority of the schedules is that there will be some increase in the number of stock upon the farms in the State. This will be due, first, to the natural turning of the settlers to live stock as a means of increasing their income and utilizing the rough forage now produced upon their claims. Second, the present high prices of all kinds of live stock will encourage stock raisers to increase their numbers and retain their "she stock" for breeding purposes rather than to fatten them for market. Taking the State as a whole, it is probable that from the several factors mentioned there will be within the next 10 years an increase of fully 15 per cent in cattle and not to exceed 10 per cent in sheep.

Calf crop.—The estimated number of calves born for each 100 head of breeding cows on the ranges in the State is 57. The number of bulls used to the 100 cows is six. This average is not believed to represent the true facts because the schedules had mainly been received from the better class of stockmen, who believe in having a sufficient number of bulls in all cases. It is doubtful, however, if, taking all the owners into consideration, the number of bulls on the range will average more than three to the 100 cows. It is believed that this accounts for the wide variation between the number of bulls used and the comparatively small calf crop. The low average value of the bulls indicates that the stockmen of Arizona can also materially increase their beef output by using a higher class of bulls.

The Arizona sheepmen have shown good judgment in breeding up their herds, and within the last 10 years there has been a marked increase in both the weight of the lambs and the wool clip.

COSTS.

Labor costs.—The reports of the labor cost involved in handling range cattle are fairly uniform from all parts of Arizona, the average being $2.43. This, of course, varies with the number of animals handled, some individuals and companies whose herds number thousands reporting that the per capita labor cost is not in excess of 50 cents, while men who have from 300 to 500 head estimate it

at from $3 to $4 per head. For these reasons the average as shown is believed to be somewhat in excess of the true labor cost, and probably a labor cost of $2 per head would be more nearly correct. The Tariff Board gives the annual labor cost of handling sheep, including shearing, as 79 cents.

The cost of feed for range animals in Arizona is, with one exception, the lowest of all the States reporting, being $1.16 per head per year. This is due to the fact that the ranges, except in extreme cases, are used the year round and very little winter feeding is practiced. The major item of this cost is covered by the grazing fees charged by the Forest Service, for which the average yearlong charge is 48 cents per head. Many of the reports state that outside of this Forest Service charge the feed cost on the open range is practically nothing. Considering the very small number of cattle that are fed hay, it is believed that this rate of $1.16 is somewhat in excess of the actual money cost for feed for one animal during a year, and that taking the average herd of range cattle throughout the State the feed cost will not exceed 75 cents. The report of the tariff board shows that the average annual cost for feed of all kinds consumed by one sheep in Arizona is 15 cents, which undoubtedly is very close to the cost of such feed at the present time.

Interest.—The average rate of interest throughout the State is shown to be 9.9 per cent. No rate below 8 per cent is reported, and the rate in the range counties is invariably above 10 per cent, so that taking the range industry by itself the probabilities are that very few if any loans are secured by range cattlemen at rates less than this average.

CALIFORNIA.

Cattle in California:		
1910 census		2,077,000
January 1, 1914		1,929,000
Decrease	per cent	7.1
Sheep in California:		
1910 census		2,417,000
January 1, 1914		2,551,000
Increase	per cent	5.5
Unreserved and unappropriated public lands in California July 1, 1914	acres	20,902,752

CHANGES IN LIVE STOCK ON THE RANGE SINCE 1910.

Cattle.—According to the schedules from stockmen, the number of cattle on the range in California has decreased 11.7 per cent since 1910. Schedules from county correspondents show an average estimated decrease of 9.2 per cent. It may therefore be concluded that cattle on California ranges have decreased 10 per cent in number since 1910. In northern Kern, Kings, Tulare, eastern Fresno, Inyo,

eastern half of Madero, and Mariposa Counties there has been an average increase of 6 per cent; in Sutter, Colusa, Glenn, Butte, and Plumas Counties an increase of 6 per cent; in Del Norte, Humboldt, Siskiyou, and Trinity Counties an increase of 8 per cent. This increase is within territory either in National Forests or largely range land adjoining National Forests. The remainder of the State, except Alameda and Amador Counties, shows a general decrease.

Sheep.—The schedules from stockmen show an estimated decrease of 12 per cent in sheep since 1910, while those from county correspondents show an average decrease of 22 per cent on the California ranges since 1910. These reports are not in accord with the Department estimates of February 7, 1914, which show an increase of 5.5 per cent. It is believed, however, that the number of sheep on ranges has actually decreased since 1910 probably 15 per cent for the State as a whole. The decrease is general for the State except for a narrow strip in the east-central part along the California-Nevada line.

FACTORS RESPONSIBLE FOR THE CHANGES.

Homesteaders.—It is estimated that approximately 7 per cent of the range lands of the State have been homesteaded within the last 10 years, and that this settlement has decreased the number of cattle 5 per cent and the number of sheep 10 per cent. Approximately 75 per cent of the new settlers are not raising live stock over and above necessary work and milch animals, and the land taken means a considerable decrease in the range, in addition to settlement interfering with former large stock interests.

Change from beef to dairy stock.—The total schedules for the State indicate an appreciable change from the beef type to the dairy type of stock. The county schedules indicate that dairying has increased, especially in the range sections adjoining the San Joaquin and Sacramento Valleys, and in the northwestern corner of the State. Elsewhere throughout the range territory of the State there has been but a slight increase in dairy stock. Approximately 30 per cent of the reports state that the change to dairy breeds has reduced the output of beef animals. While it is believed that the change has resulted in a slight decrease of beef production, it would not amount to more than perhaps 1 or 2 per cent. The main effect has been an increase in total number of stock.

Deterioration of range.—The schedules from stockmen show an average estimate of 21.2 acres as the area necessary to support a cow for the average season of 9.5 months. The county schedules give 13 acres as the average acreage per cow for 9.5 months. For the foothill range in pastures 13 acres is about right, but for the State as a whole even 21.2 acres is considered too low. Much of the brushy

Forest range requires 30 acres per cow for a 5-month season. The average area per cow for 9½ months is thought to be about 25 acres.

The majority of the schedules state that this acreage is higher than 10 years ago—that is, the ranges have decreased in carrying capacity. Schedules from stockmen place the decrease at 7.84 per cent; county correspondents place it at 2.6 per cent. Considering the effect of homesteading the best lands, incoming of brush, severe droughts, and overgrazing, it is believed that 7.84 per cent decrease is not too high. Twenty-five per cent of the schedules from stockmen give an average estimated increase of approximately 20 per cent in carrying capacity due to better management of range and improved methods of handling stock. This improvement applies largely to National Forest range. The average decrease reported is approximately 30 per cent. While some of the reported decreases apply to National Forest ranges, where brush and timber under protection are shading out grass, the large majority apply to the public domain and private range.

The reasons given for increase in carrying capacity are (1) better management of the range under regulation, and (2) improved methods of handling the stock. The average 20 per cent increase for reports of this character is of interest in showing the possibilities of proper management.

The reasons given for decrease are (1) overstocking; (2) prolonged droughts; (3) fencing up areas of choice range; (4) the incoming of brush and timber, which reduces the total area of usable range and decreases the forage on what is left. By far the majority give overgrazing and bad management as the cause of deterioration.

To summarize this topic, it may be said that more than half of the range, mainly public domain and private holdings, has deteriorated an average of 30 per cent in carrying capacity during the last 10 years as the result of overgrazing; that a small per cent has not changed; approximately 25 per cent has increased by an average of 20 per cent in carrying capacity, due to regulation and improved handling of stock; and that the average for the State is a decrease of about 8 per cent.

HOW THE NUMBER OF LIVE STOCK IN THE STATE CAN BE INCREASED.

Public range.—A few local areas of both summer and winter range, mainly summer range, are reported not used on account of lack of water, inaccessibility, an excess of brush, and, in one instance, lack of stock. A full use of range at present unused would not, however, make an appreciable increase in the number of stock in California.

The schedules from stockmen were almost unanimous in stating that the range lands now occupied could be made to carry more stock, but only a few of them gave figures for the estimated increase.

California forests on the west slope show a gradual increase in reproduction of timber and brush under adequate fire protection with some decrease in range. On the other hand, further improvement in management and development will result in an increase of probably 10 per cent in carrying capacity for the more open lands. The outside ranges undoubtedly can be improved by control and better management. The probable increase in carrying capacity of the range lands now being used should not be put at more than an average of 15 per cent.

More stock on farms and homesteads.—On this point the average of the schedules shows an estimated increase of 17.2 per cent in the case of cattle and 6.7 per cent in the case of sheep. It is safe, therefore, to assert that in California an increase in cattle, not to exceed 15 per cent, may be expected, and perhaps a slight increase in sheep. These estimates are, of course, based on the assumption that there will be no change in management of public lands.

While a few of the schedules base the estimated increase on anticipated range control and better range management, the great majority state that farms and ranches are at present understocked. As a result of high prices the farmers and settlers will turn to live stock, the increase will be saved, more hay will be produced as a result of general farm development, there will be generally greater care and economy in the utilization of pastures and hay, and beef and mutton feeding, as well as winter feeding of stockers, will increase. It is believed that this represents the true situation, and if so the whole question hinges on continued high prices rather than development of new areas or a tendency to use live stock as a fundamental requisite in a successful system of agriculture. Until this last principle is recognized, it will be difficult to have a stable continuous increase in live stock proportional to increase in population.

It is estimated that approximately 3 per cent of the remaining range lands are suitable for cultivation. Therefore, this factor can hardly have any material aggregate effect on production of meat. The subtraction of such lands from the range will eventually be compensated by the production of small numbers on the homesteads.

Better breeding animals and larger increase.—Better control of stock and range, general tendency toward better care of stock, and increased necessity for attention to the individual animal as available range decreases and cost of production per animal increases will result in improvement of the average animal and increase in the percentage of calf crop.

COLORADO.

Cattle in Colorado:	
1910 census	1,128,000
January 1, 1914	1,135,000
Increase, less than 1 per cent.	
Sheep in Colorado:	
1910 census	1,426,000
January 1, 1914	1,668,000
Increase—per cent	17
Unreserved and unappropriated public lands in Colorado, July 1, 1914—acres	18,899,441

CHANGE IN LIVE STOCK ON THE RANGE SINCE 1910.

Cattle.—According to the census reports, there has been a slight increase in the number of cattle in the State, amounting to 7,000 head. An analysis of the census figures shows that this increase has been in the number of milch stock and that, so far as the range is concerned, there has been an actual decrease of range animals. The greater portion of this decrease is naturally in the open plains region east of Denver. Here the settlers have made tremendous inroads into the open range, and there is a wide difference of opinion as to whether or not the taking up of this range by settlers under the dry-farming system will prove permanent. At the present time the conditions are rather unsettled, but from a study of the schedules received in this investigation there seems to be a general feeling that the majority of these dry farmers will eventually get a foothold and improve their farms, so that in time they will naturally turn to live stock and thus increase the number of cattle and sheep.

In the northwestern corner of the State, in the counties of Montrose and Rio Blanco, there has been a falling off in the number of cattle of from 5 to 20 per cent. Here the loss is ascribed to the advent of the settler and his encroachments on the range and also to several unusually dry seasons which have forced the sale of a great many cattle that otherwise would have been kept for breeding purposes.

In the southwestern corner of the State, in Gunnison, Saguache, San Juan, Montezuma, and several other counties, the schedules indicate an increase in the number of cattle of from 5 to 20 per cent. This appears to be due to the excellent condition of the range within the National Forests in that region and the Government control over these ranges, which has restrained the migratory stock so that the local settlers have had more favorable opportunities for using the range about their homes. It is doubtful, however, if the increase is as great as that shown by the schedules.

Sheep.—There has been a very considerable increase in the number of sheep in the southwestern corner of the State and also in Routt County. The increase in the southwestern part of the State is doubt-

less due to improved conditions in the National Forest ranges and the development of the pea-feeding industry in the San Luis Valley tributary to several of the Forests. With the exception of one or two small areas, the rest of the State shows a decrease of from 5 to 25 per cent in the number of sheep. It is believed that considering all the factors obtainable there has been an increase in the number of sheep in the State of probably not over 10 per cent.

FACTORS RESPONSIBLE FOR THE CHANGES.

Taking the State as a whole, the indications are that the homesteaders have taken up about 15 per cent of the open range land in the last 10 years. The advent of these settlers seems to have temporarily decreased the numbers of both sheep and cattle from 4 to 10 per cent, but the majority of the schedules state that the new settlers are already turning to live stock, and eventually the number of stock in the State will be increased on that account. While the census figures indicate some increase in the number of dairy cattle in the State, the schedules are very emphatic in the statement that settlers as a general rule are not raising dairy stock, but find it more profitable to raise beef cattle or, in some instances, sheep.

Deterioration of the range.—The majority of the schedules show that the open range in the State of Colorado has not materially decreased in its carrying capacity during the last few years, while in some parts a positive improvement is reported. The average acreage required for one cow for the seven months' period is estimated at 18 acres by schedules from stockmen and 15 acres by those from county correspondents. Considering the character of the land left open, it is quite certain that it will require fully 25 average acres to carry one cow. A large number of the individuals reporting believe that the range can be improved in several different ways. Many state that Government control such as is in force on the National Forests would greatly improve matters. Others believe that the prairie dogs now infesting thousands of acres of these ranges should be killed off. Still others mention migratory sheep as being the cause of the overgrazed condition of some of the ranges. Several look forward to an ultimate improvement in the stock business because they believe that as fast as the settlers obtain patents to their land they will sell it to the stockmen, who will thus place more stock on the ranges than they can care for at present. All these things point to proper control through some strong central authority as the only means for restoring the range to something of its old condition.

Better grade of stock.—The value of the bulls used in the State of Colorado averages $131.90, which is much higher than in the States to the south and southwest. In the western part of the State especially the stockmen have in recent years done much to build up

the grade of their herds, and the hay-fed steers that are turned off from the hay-feeding ranches on the western slope are a very superior class of beef animals.

Weight of steers.—The average weight of steers turned off from the ranges in the State is 883 pounds for twos and 1,084 pounds for threes. The reports coming from the western part of the State, in the mountainous region, indicate a higher average than these, but the general average for the State is somewhat reduced by the lower weights of the steers sold from the open range areas east of Denver, the most of which go to the market as feeders, not as fat stock.

POSSIBILITY OF INCREASING THE NUMBER OF STOCK IN THE STATE.

While practically all the available range in the State outside the National Forests is at present fully occupied either by sheep or by cattle, much of it is in such a condition that with some form of Government control its carrying capacity could undoubtedly be greatly improved. The ranges on the National Forests have greatly improved since they were placed under supervision, and their carrying capacity is increasing year by year. There is room in nearly all the National Forests in the State for more cattle and sheep than are now grazed upon them. The difficulty of filling up these ranges lies in the wintering of the animals. The ranges in the National Forests are available for not more than five or six months of the year, and the only means by which the number of stock grazing upon them can be increased will be through (1) development of irrigated lands in the vicinity of the Forests where hay and other forage can be raised with which to carry the animals through the winter, and (2) improvement of the open ranges. In the next 10 years the schedules from stockmen estimate the increase in cattle at 14 per cent; in sheep, 39 per cent. The schedules from county correspondents estimate the increase in cattle at 33 per cent; in sheep, 10 per cent. An increase of 20 per cent in cattle and 15 per cent in sheep is a conservative estimate for the two classes over the entire State.

Calf crop.—The estimated number of calves born for each hundred head of cows is 69.3 per cent. The estimated number of bulls used to the hundred cows is 4.4, which is approximately correct.

COSTS.

Labor cost.—The schedule figures showing the labor cost involved in handling range cattle in the State are reasonably uniform, the majority ranging from $2 to $5, with an average cost throughout the State of $2.76. This probably is a little higher than the actual cost to the owners, owing to the fact that there are not many large herds

within the State, the majority of the herds being small, and upon such herds the per capita labor cost is always rather excessive. The report of the Tariff Board indicates that the labor cost for sheep in the State, including shearing cost, is 60 cents per head, and the cost of feed for the year 26 cents per head. It is probable that both of these items are somewhat higher to-day than they were in 1912, when the report was made, especially the feed cost, which probably to-day will average 30 cents per head. The Colorado sheepmen are feeding their sheep more generally to-day than they have in the past, which adds considerably to the cost.

Interest.—The average annual rate of interest charged in the State on stock loans is 8.8 per cent. A few reports were given for as low as 7 per cent, but these were undoubtedly extreme cases and probably the average shown is approximately correct.

Depreciation.—The average depreciation on cows is estimated at 5.3, and the average depreciation on bulls at 18.3 per cent. In figuring the depreciation on cows, as in other States, the majority of the stockmen maintain that there is no depreciation loss, the animal being sold as beef for her full cash value. It is not believed, however, that this will hold good for the entire State, and the depreciation established for the two classes of animals is undoubtedly very nearly the true figure.

IDAHO.

Cattle in Idaho:		
Census of 1910		454,000
January 1, 1914		466,000
Increase	per cent	3
Sheep in Idaho:		
Census of 1910		3,011,000
January 1, 1914		2,981,000
Decrease	per cent	1
Unappropriated and unreserved lands in Idaho, July 1, 1914, acres		16,342,781

CHANGES IN LIVE STOCK ON THE RANGE SINCE 1910.

Cattle.—Schedules from stockmen show an average decrease of 15 per cent in the cattle on Idaho ranges since 1910; the schedules from county correspondents show an estimated increase of 4.3 per cent. A study of the schedules by units shows the decrease to be general, except in Bonner and Ada Counties; in the northern half of Boise County, Custer County, and Fremont County, in the central part of the State; and in Gooding County and around the Minidoka Forest, in the south-central part of the State. The change in Fremont and Gooding Counties is due, however, more to increased dairying and cattle on farms than to cattle on the range. Development here has been intensive, transforming waste land into irrigated fields. The

estimate of 4.3 per cent increase may represent the total of the State fairly well, owing to increase in dairy cattle, but a decrease of 10 per cent will probably be a conservative estimate for cattle on ranges.

Sheep.—The schedules show an estimated average decrease of 11.8 per cent in the sheep on ranges in the State since 1910. They also attribute an average decrease of 12.9 per cent in sheep in the State to homesteading. Only Bonner, Clearwater, Custer, Lemhi, Twin Falls, and Canyon Counties show a rather marked increase. In these counties a great deal of mountain range has been opened to sheep grazing within recent years by developing roads and trails and securing arrangements for feeding in transit during the summer months. The former big sheep section of the State shows a decided decrease in the number of sheep produced. It is believed the average estimated decrease of 11.8 per cent is low rather than high.

FACTORS TO WHICH THE CHANGES ARE DUE.

Homesteading.—The county correspondent schedules show an average estimate of 42.2 per cent of range lands homesteaded within the last 10 years. Schedules from stockmen give 25 per cent as an average estimate. Twenty-five per cent is considered the more nearly correct, owing to the large acreage of rough mountain territory remaining in the State. It is estimated that this homesteading factor alone has resulted in a decrease of about 10 per cent in the number of cattle and 12.9 per cent in the number of sheep. Without doubt this has had more to do with the decrease than any other single factor. In the southern half of the State public domain range to-day is, comparatively speaking, almost a thing of the past. The fact that the decrease in live stock due to homesteading exceeds the total estimated decrease is explained by the fact that the opening of new ranges in northern Idaho has resulted in an increase, and, further, the development of irrigation on formerly waste lands in certain counties of central Idaho has resulted in an increased production of hay and a consequent increase in live stock. The majority of the homesteaders and new settlers, however, are not yet raising live stock over and above the necessary work and milch animals, although in the northern part of the State, where homesteads are largely for live stock purposes, and also in a few irrigated sections, many settlers are doing so, but for the larger sections, where dry-land farming is predominant, they are not.

Change from beef to dairy type of cattle.—For the State as a whole there has been a marked increase in dairy cattle. This change has taken place largely in the central and north-southern parts of the State—the main irrigated section—and in the extreme north of the

State. In the northern—that is, the main mountainous region—and in the extreme southern part, there has been no appreciable change. In other words, there has been no change in the main range sections, but an appreciable change in the larger intensive farming sections. The effect of this change upon the total output of beef animals has been a reduction, but not to the extent of the proportionate increase in dairy cattle, owing mainly to the fact that where dairying has increased the dairy cattle are an increase over the former number of cattle, and in part to the fact that the dual purpose cow is still used in some sections of the State where dairying has increased. It may safely be concluded, then, that increase in dairying has resulted in only a slight decrease in the output of beef cattle, and has resulted in maintaining or increasing the output of veal by the selling of calves from dairy herds.

Deterioration of range.—For an average period of 7 months the live stock are grazed on the range. For this period, the average estimated area necessary to support a cow is 18 acres. It is estimated that this average acreage for the State is about 6 per cent higher than that of 10 years ago; that is, a decrease in carrying capacity of approximately 6 per cent. This does not show the actual facts, however. The average of estimates from stockmen shows approximately 30 per cent increase in carrying capacity on National Forest range, and approximately 50 per cent decrease in carrying capacity on the open ranges. This in the main is believed to be about correct, perhaps slightly high on both estimates. It shows the main fact, a considerable increase in carrying capacity under regulated use and a marked decrease without regulation.

The principal reason given for a reported increase in carrying capacity is National Forest supervision. Occasional reports give more precipitation as the cause, others a decrease in number of stock which is in line with regulation. The principal reasons for decrease in carrying capacity are overstocking, especially with sheep, and homesteading of the best range lands. Jack rabbits are given as a partial cause in one section.

Better grade of stock.—In Idaho, as elsewhere, the tendency to give more attention to the individual animal and less to numbers has no doubt worked toward a slight decrease in number, without a decrease in the pounds of meat produced.

HOW THE NUMBER OF LIVE STOCK IN THE STATE CAN BE INCREASED.

Public range.—Throughout northern Idaho there is considerable unused range. There are several reasons for this, the chief reason being a shortage of winter range and a lack of farms and ranches to

FIG. 1.—GROUP OF 2-YEAR-OLD RANGE STEERS, WHITE RIVER NATIONAL FOREST, COLORADO.

The Colorado stockmen as a rule use bulls of a very high grade.

FIG. 2.—BUNCH OF 2-YEAR-OLD STEERS RAISED ON OPEN RANGE IN SOUTHERN NEW MEXICO.

There are many large herds of high-grade cattle in New Mexico.

grow forage and stock in proportion to the summer range available. Additional reasons are the facts that the unused range is rugged, remote from settlement, and difficult to reach, and that the danger of loss of stock is proportionately great. Of recent years the Forest Service has opened part of the range by necessary trails, roads, and bridges, and has induced sheepmen to ship sheep for summer grazing from congested sections farther west. The more easily accessible portions of this available unused range will undoubtedly be gradually brought into use, but the lack of balance between winter range and forage crop production on the one side, and summer range on the other will make increase in utilization slow and full utilization a remote possibility. A continuation of the present campaign by the Forest Service, with money for development when necessary, is about all that can be done toward further use. Throughout the central and southern portions of the State local areas of both summer and winter range are reported unused because of lack of water. On some areas available water has been fenced by settlers. On the Forests no water has existed. Water development in part is feasible as soon as money is available and there is positive demand for the range. As a whole, it may be concluded that there is a possibility of a small average increase in stock due to development of range at present unused.

Slightly more than 80 per cent of the schedules state that the range in their respective vicinities could be made to carry more stock. Restriction of grazing, Government regulation, revegetation, reseeding, and water development are the primary means cited to bring about the improvement. All of these means are dependent for success upon control of both range and stock. A number of reports suggest clearing off brush and timber; a few irrigation; some say private ownership; in part of the northern territory trails and drift fences are needed; fencing is advocated in a few reports.

Few of the schedules give an estimate of the possible increase. Estimates given vary from 15 per cent to 100 per cent, with an average of 34 per cent. The estimated decrease in carrying capacity of public domain has been placed at 50 per cent; the increase thus far due to Forest regulation has been estimated at 30 per cent. The Forest ranges should increase perhaps 15 per cent through further improvement in vegetation and better handling of stock. The public domain under proper regulation and development should increase eventually 50 per cent, making a possible average increase of perhaps 25 per cent for the State. This increase in neither case would be immediate. It could hardly be reached, under most favorable management, in less than 10 years at best. Lack of regulation means a further decrease on the public domain.

35466°—16——5

More stock on homesteads and farms.—The schedules from stockmen show an estimated increase of 7½ per cent in the number of cattle within the next 10 years, while those from county correspondents give an average estimated increase of 41.3 per cent in cattle and 14.5 per cent in sheep within 10 years. The estimate of 7½ per cent increase from stockmen represents more strictly the range and ranch business; the estimate of 41.3 per cent from county correspondents represents the farm end. Probably a safe average estimate for the increase in cattle would be 20 per cent and for sheep 10 per cent.

The reasons given in support of this expectation of increase are many, but they may be grouped into the following main ideas: (1) High prices make live stock more profitable than grain raising; (2) farmers and settlers will have to grow more live stock to make their property pay; (3) a marked increase in the dairy business; (4) development of live stock feeding for beef and mutton; (5) better care of all live stock. Back of all these, except dairying, is the attraction of high prices. The men will grow the crop that produces the most money. One difficulty lies in the fact that many indirect money benefits from live stock have not yet come to mean money value to the land owners. High prices offer an unstable incentive. The effort should be to base the advantages of live stock on farms and ranches on their value in the maintenance of crop fertility and utilization of by-products or secondary products.

It may be pointed out again that approximately 25 per cent of the former range lands have been homesteaded within the last 10 years; and that the majority of the new settlers are not producing live stock over and above their necessary work and milch animals. It is estimated that approximately 10 per cent of the remaining public domain land is suitable for agricultural homestead entry. This estimate is perhaps a little high for the State as a whole. Undoubtedly the settlers of most of these lands will grow a few animals as soon as they can get money or credit sufficient to make the purchase. The homestead must first be developed to some value before money can be borrowed to buy live stock, and even then money on breeding stock is hard to get, so that development of the live stock industry on the dry-land homesteads will be slow.

Better average animals and larger increase.—In Idaho, as elsewhere throughout the range States, there is a possibility of improvement in the average animal, both sheep and cattle, and a possibility of higher percentage of increase. The increase in prices, increase in winter feeding, and lack of range for large numbers, all work toward improvement of the individual animal rather than increase in numbers as a means of increasing net profit. This factor should result in perhaps a 5 per cent increase in the output of beef in pounds.

MONTANA.

Total cattle in Montana:		
Census of 1910		943,000
January 1, 1914		857,000
Decrease	per cent	9.1
Increase in milch cows	do	39.0
Decrease in cattle other than milch cows	do	13.0
Sheep in Montana:		
Census of 1910		5,381,000
January 1, 1914		4,293,000
Decrease	per cent	20.2
Unreserved and unallotted lands in Montana, July 1, 1914		22,237,660

CHANGES IN LIVE STOCK ON THE RANGE SINCE 1910.

Cattle.—Figures of the Bureau of Crop Estimates (February, 1914) show a decrease of 9.1 per cent in cattle since 1910; an estimate from the State stock commissioners shows a decrease of 26 per cent since 1910; schedules received from county correspondents show an average estimated decrease of 26.3 per cent; and schedules from stockmen and Forest officers show an average decrease of 41 per cent. It appears safe to decide upon an average decrease of not less than 26 per cent in cattle on the range since 1910, as all reports show an increase in dairying. It is of interest to note in this connection that there has been a marked increase since 1912, thus showing an upward tendency.

Sheep.—Figures of the Bureau of Crop Estimates (February, 1914) show a decrease of 20.2 per cent in sheep since 1910; the schedules from county correspondents show a decrease of 42.9 per cent; those from stockmen and Forest officers show a decrease of 42 per cent, and State statistics show a decrease of 37½ per cent. It is safe to conclude that sheep in Montana have decreased approximately 40 per cent since 1910. The decline has been continuous, but most rapid during 1913.

FACTORS RESPONSIBLE FOR THE CHANGES.

Homesteaders.—General Land Office figures for July 1, 1914, place the unreserved and unappropriated lands in Montana at 22,237,660 acres. Schedules from county correspondents show an average estimate of 61.7 per cent of the former range lands homesteaded within the last 10 years; those from stockmen show an average estimate of 40 per cent; State figures show approximately 70 per cent filed on from July 1, 1913, to October 1, 1914. Undoubtedly the Government estimates do not exclude the large area filed on within the last 6 months. It is safe to conclude (1) that the area of former range lands homesteaded in the last 10 years will total approximately 40

per cent of the range lands including Forests, or 65 per cent of the former range lands outside of the Forests; (2) that the unreserved and unappropriated land in the State is now (January, 1915) somewhat less than the 22,237,660 acres shown by the Land Office figures of July 1, 1914.

Schedules from county correspondents as an average show that this settlement has reduced the number of cattle 18.4 per cent and the number of sheep 46.1 per cent; those from stockmen show an average estimated decrease of 30 per cent for cattle and 37.7 per cent for sheep. These estimates are based on total stock, and it is a fact that settlement has increased the total number of milch cows. It is safe then to conclude that settlement of range lands has reduced the number of cattle on ranges aproximately 30 per cent and the number of sheep approximately 40 per cent the last 10 years.

It is a fact that the open range live stock business, as it was formerly known in eastern Montana, is almost a thing of the past. To date the new settlers have devoted attention primarily to raising wheat and flax. A few, not to exceed one-third, are raising a small number of live stock above necessary work and milch animals. The majority have not been under way long enough to develop the forage, improvements, and credit necessary to live stock production. Wheat and flax bring quick money returns, breeding cattle are much slower, and it takes less ready money to produce a grain crop than to purchase a foundation of live stock. Aside from the reduction of stock due to taking away the land actually settled, the settlement frequently leaves isolated bodies of public land without water and difficult to use.

Change from beef to dairy cattle.—The Department estimates of February 7, 1914, show an increase of 39 per cent in milch cows since 1910. The county correspondents and stockmen report a change from beef to dairy cattle in approximately half the localities of the State. It is probable, then, that dairying has increased at least 30 per cent. Dairying has increased mainly near the centers of population, and the result is an increase in total cattle rather than a reduction in beef cattle equal to the total increase in number of dairy cows. Further, in much of the dry-farming section the dual-purpose cow is still used as the milch cow. The aggregate effect of increased dairying, then, is an increase in total cattle and a slight decrease, probably 1 per cent, in the output of beef.

Deterioration of range.—County correspondents show the average season for grazing to be 9.6 months; schedules from stockmen show an average season of 8 months. It is believed that the county reports include farm pastures, and that, therefore, 8 months is about correct. For this average season the average estimated area neces-

sary to support a cow is approximately 15 acres. The schedules from stockmen show as an average that this acreage is 9 per cent higher than 10 years ago; those from county correspondents show an estimated increase of 1.2 per cent. Large decreases in carrying capacity are reported for the main stock sections. Increases reported for National Forest range will partly offset the decrease on uncontrolled range. It is concluded, therefore, that the average decrease in carrying capacity of range lands in the State is about 7 per cent. The decrease in carrying capacity is attributed in about equal proportion to overstocking and premature grazing and to the settlement of the best range lands. Increases in carrying capacity reported are attributed to improvement in the management of range and stock. These increases are largely on National Forests or on lands outside the Forests which have been placed under fence. Here, then, as in other States, the estimates show a decrease in carrying capacity on uncontrolled lands and an increase on lands under regulation and improved management. The aggregate effect upon the stock industry has been partly included in the 30 per cent reduction in cattle and the 40 per cent reduction in sheep already attributed to homesteading. There is probably 5 per cent reduction not thus included, but this is offset by the increase as a result of increase in hay crop and winter feeding on the older farms and ranches, which has decreased the demand per animal for range.

HOW THE NUMBER OF LIVE STOCK IN THE STATE CAN BE INCREASED.

Public range.—On the summer range, which is largely in National Forests, it is estimated that there will be little increase of cattle. In the western part of the State it is estimated that perhaps 100,000 more sheep can eventually be cared for, and on the remainder of the Forests in the State it is estimated that eventually a 25 per cent increase in sheep (187,500 head) can be made by complete adoption of improved methods of handling sheep. This means a total estimated increase of 287,500 head of sheep, approximately 7 per cent of the present State production, and no increase in cattle on National Forests. It will probably take 20 years to completely revise methods of handling and accomplish this increase.

Of the schedules from stockmen, 75 per cent state that the range lands could be made to carry more stock. Where the increase is shown in figures it varies from 10 per cent to 50 per cent, with an average of 20 per cent. Taking into account the small number reporting no possibility of increase, the reports from stockmen are interpreted to represent an average estimated possible increase in carrying capacity of approximately 15 per cent for all range lands of the State. This is believed to be conservative.

The means cited for bringing about this increase are (1) regulation or leasing of public-domain lands, regulation similar to National Forest management being recommended; (2) water development and trail construction; (3) improvement in the methods of handling the stock, including drift fences, salting, fly sheds, herding sheep; (4) reseeding to cultivated forage plants. It is apparent that some form of regulation and long tenure of use is the keynote to the whole situation—this in order to justify construction of improvements and make possible improved methods of handling both range and stock. On National Forests the need for trails and drift fences is gradually being met. On the public lands nothing can be done until the lands are placed under some form of regulation.

More stock on farms and homesteads.—The schedules from stockmen show an average estimated increase of 53 per cent in cattle and 18 per cent decrease in sheep for the next 10 years; those from county correspondents show an average estimated increase of 46.3 per cent in cattle and 14.5 per cent decrease in sheep. In each case the estimates are based almost entirely on the belief that both farmers and homesteaders will raise more cattle, and that present settlement and further settlement will be conducive to cattle production rather than sheep production. The main reasons for expecting these changes are the following: (1) Dry farmers will have to raise stock to make the homesteads permanently profitable; (2) high prices of cattle make cattle production more profitable than grain growing; (3) increase in the production of feed and consequently a necessary increase in cattle to consume it; (4) general development of ranches will be accompanied by growing of more cattle; (5) perhaps part of the present homesteaders will fail on their holdings and will sell them to stockmen, who will make them cattle producing, under fence; (6) increase in dairying among dry farmers.

Continued high prices for beef and somewhat lower proportionate prices for grain will hasten the production of more cattle. The increase will come only gradually at best, however, as it is dependent largely upon the dry farmers. In the majority of cases it takes several years to place a dry farm on a basis suitable to live stock production, both from the standpoint of forage and improvements and of credit. Grain gives a quick money return for small outlay of actual cash, and this is what the dry farmer, as a rule, must have during the period of becoming established. Further, many of them will continue producing wheat and flax until the land becomes nonprofit-producing, because they will not risk a change. It is generally conceded among themselves and among experts, however, that the dry farmer of Montana must eventually get away from the one crop, and that the alternative will be the addition of live stock.

There is opportunity for small bunches of sheep to utilize waste corners and keep down weeds on fallow land in connection with dry farms as well as the more intensive farms. It is believed that sheep production along this line will be developed and must be developed if mutton and wool production is to keep pace with increase in population. Here, as elsewhere, however, cattle rather than sheep will be used in the early stages of transformation from range live stock production to farm production. Consequently no development of magnitude is expected in sheep production on farms in Montana the next 10 years.

One of the essentials to development of successful live stock production on Montana dry farms is the working out of successful forage crops and the introduction of the silo. Montana winters are cold, consequently stock will need feed for four to five months, and there is little hay grown. If crops can be grown which will be suitable for a ration in combination with straw and grain if necessary, live stock production will mean utilization of by-products now burned or otherwise wasted. A further wise plan will be to parcel out available public-domain range lands and allow fencing, so that the maximum stock can be run at minimum cost outside of the farms in summer.

Summarizing this topic, it is concluded (1) that cattle will increase approximately 45 per cent in Montana during the next 10 years whether action is taken to improve the management of remaining public-domain range lands or not, and that sheep will probable decrease about 10 per cent; (2) that the total increase for the State can be made to reach 50 to 55 per cent by regulation and proper management of the remaining public-domain range lands; and (3) that the main increase will come about by increased production of more stock on the vast acreage of dry lands which has passed to private ownership.

Better breeding animals and larger increase.—Montana produces at present good grade cattle and good grade sheep. Here as elsewhere throughout the range States, however, there is possibility of improvement, both in grade and in natural increase. Development of the stock industry on farms and homesteads, increased cost of production on ranges and farms, increased care of individual animals due to their increased individual value, increasing tendency to market by weight rather than by the head, will all tend toward the improvement of the average individual animal and consequently the whole. These same factors will create sentiment favorable to adoption of suggestions from Government and State experts. It is believed safe to assume, therefore, that the average weight of beef animals now given as 991 pounds for a long 2-year-old steer will

increase, and that the average calf crop now given as 75 per cent will increase approximately 10 per cent.

NEVADA.

Cattle in Nevada:	
1910 census	450,000
January 1, 1914	459,000
Increase—per cent	2
Sheep in Nevada:	
1910 census	1,155,000
January 1, 1914	1,517,000
Increase—per cent	31
Unreserved and unappropriated land in Nevada July 1, 1913—acres	55,502,439

CHANGES IN LIVE STOCK ON THE RANGE SINCE 1910.

Cattle.—The schedules from stockmen and Forest officers show, for the State as a whole, an estimated decrease of approximately 15 per cent in the cattle on the range since 1910. The schedules from county correspondents show an estimated decrease of 4.3 per cent. This discrepancy is partly explained by the fact that county correspondents are more representative of the farm side, while stockmen are more representative of the larger range interests. Elko County and a smaller area in Humboldt County are the only areas of magnitude showing an increase. Local areas elsewhere report increase, but are overshadowed by other reported decreases. It is safe to say that there has been a decrease of 10 per cent in cattle on the ranges of Nevada since 1910.

Sheep.—It is estimated that sheep in Nevada have increased 20 per cent since 1910. Large increases are reported for the whole eastern part of the State, and in Washoe County, in the western part of the State, while a slight increase is noted in the northern part and little change in the whole central part. Part of this increase is due to the fact that large herds of sheep have in late years been forced to Nevada from adjoining States for winter range. A part of them, therefore, have probably been considered in the estimates for California, Utah, and Idaho. Accordingly, the above variation from the Department estimates of February 7, 1914, seems justified.

FACTORS RESPONSIBLE FOR THE CHANGES.

Homesteaders.—It is estimated that approximately 4 per cent of the range lands have been homesteaded within the last 10 years. (County schedules estimate 5 per cent, stockmen's schedules 3¼ per cent.) The majority of the new settlers are not raising live stock over and above the necessary work and milch animals. A few reports from county correspondents state that live stock above work

and milch animals is being raised by new settlers, mainly in the counties near the agricultural section around Carson City and in a few localities of Elko and Humboldt Counties. It is doubtful if this small-scale production has yet reached a magnitude which appreciably changes the total figures for the State. On the other hand, it is estimated that the settlement of the lands by homesteaders has decreased the number of cattle about 3 per cent and has had no appreciable effect upon the sheep. The small acreage of homesteads could hardly change the large desert sheep industry. The growing of more hay, however, might result in local increases due to feeding and at the same time decrease the number of range sheep locally. The schedules submitted are so interpreted.

Change from beef to dairy cattle.—On this point all the schedules show a change in the counties cornering near Carson City. This change is no doubt due to the incoming of irrigation agriculture. Elsewhere in the State there has been no appreciable change. The slight change to dairying probably has slightly increased the total stock of the State but has had little or no effect upon the output of beef, as the dairy stock are dairy breeds and not dual-purpose cows.

Deterioration of range.—For the State as a whole it is estimated that an average of 36 acres of the range lands is required to support a cow for the average grazing season of 8.8 months. With two exceptions the schedules from county correspondents state that this acreage is higher than the acreage required 10 years ago. The average estimated increase is 10.1 per cent. The schedules from stockmen show as an average that the acreage necessary has slightly increased. A number report a decrease in acreage necessary, due to National Forests. Considering all factors, it is concluded that National Forest ranges have increased in carrying capacity and public domain ranges have decreased approximately 10 per cent and that the average for the State is a decrease in carrying capacity of about 8 per cent.

This conclusion apparently conflicts with the estimated increase in total stock. The plausible explanations are that the range is more heavily overstocked than formerly; that unwatered ranges are being more fully utilized than formerly; that increase in the amount of hay grown and fed has relieved the ranges; and that the development of the lamb trade and the furnishing of steers to be fed elsewhere has materially reduced the drain on the range for a given number of mature stock. This last item has probably had more to do with the apparent discrepancy than any other.

The main factors cited as responsible for the changes in carrying capacity are overgrazing, especially with sheep, on the public domain, resulting in a decrease in carrying capacity, and regulated grazing,

resulting in an increase in carrying capacity on National Forests. For the public domain overgrazing is given in all cases of reported decrease in carrying capacity. Here, as in the other States, the data point to regulation of both the number of stock and the methods of managing them as the prime factor necessary in range maintenance.

HOW THE NUMBER OF LIVE STOCK IN THE STATE CAN BE INCREASED.

Public range.—With few exceptions the reports state that the ranges are all in use and fully stocked. Isolated areas throughout the State are reported unused because of lack of water. The desert conditions will probably prevent water development sufficient to secure full use. One report from Churchill County and one from Mineral County show unused range because stock cattle are not available. This no doubt is a temporary condition. As a whole, then, it may be concluded that only a negligible percentage of Nevada ranges which are capable of future use are now unused.

Of the total schedules received, however, a majority report that the ranges of Nevada can be made to carry more stock, and a few report that they can not. The methods cited as a means of bringing about the improvement are, in order of importance, control and regulation of the grazing lands, 16; water development, 18; reseeding or revegetation and killing off sagebrush, 5; killing off wild horses, 1.

Water development includes many suggestions of "drilling wells." On the whole this would perhaps be the only way to secure necessary water, owing to lack of sufficient precipitation for supplying surface water. The feasibility of drilling in this territory is not known by the Forest Service, and the reports say nothing as to possibility of success along this line. Reseeding, except by natural revegetation, is impracticable. To accomplish revegetation, therefore, necessitates control of range and stock, and reports recommending it are to be considered as increasing the number of reports in support of control. Government control is cited wherever the desire for control is mentioned.

The reporters who say the ranges could not be improved apparently base the statement on the fact that in their localities desert range predominates.

Only a few reports give a quantitative estimate for the increase in carrying capacity which should follow Federal control, regulation of grazing, and development, and these are too few in number to be usable. It is estimated, however, that the ranges have deteriorated as a whole 8 per cent. Further, it may be conservatively estimated that range control, development, and the improvement in handling of stock which would follow would result in 10 to 15 per cent more stock being produced on the present amount of forage. Therefore,

20 to 25 per cent is believed to be a conservative estimate of the possible increase in stock which would ultimately follow control and development of Nevada ranges. On the other hand, continuation of overstocking and unregulated grazing will result in further decrease in carrying capacity.

More stock on farms and homesteads.—The schedules from stockmen show an average estimate of $1\frac{3}{5}$ per cent for the expected increase in cattle within the State of Nevada in the next 10 years. The schedules from county correspondents give an average estimate of 39.8 per cent increase in cattle and 34.4 per cent increase in sheep.

The stockmen reporting were undoubtedly looking at the question primarily from the range standpoint, as the reasons given in support of an estimated probable $1\frac{3}{5}$ per cent increase are that while high prices will tend toward the production of more stock, both on range and on farms, the increase will be largely offset by decrease in acreage and in carrying capacity of the grazing lands, provided the present lack of management continues. The estimated increase is based on the supposition that no change will be made.

The schedules from county correspondents cite the following reasons in support of an estimated increase of 39.8 per cent in cattle and 34.4 per cent increase in sheep:

(1) General development and improvement of farms and ranches will result in considerable increase in production of hay (alfalfa mentioned most). Lack of market for hay will result in increased live stock production to utilize hay.

(2) High prices for stock will increase effort to produce more forage and more stock. The proportion of breeding stock will increase, and better care generally will be given all stock, with resulting higher production.

(3) Development of artesian water will increase live stock production on many ranges.

The estimate from stockmen is believed to be too low, and the estimate of county correspondents too high. Nevada still has 55,502,439 acres of unallotted and unappropriated lands, of which schedules from stockmen estimate that 4 per cent is suitable for cultivation, while the corresponding estimate from county correspondents is 24.4 per cent. The remaining large acreage is desert in character and will decrease in carrying capacity unless placed under regulation. It is not believed that agricultural development alone in Nevada in the next 10 years will be of sufficient magnitude to increase production for the whole State anything like 39 per cent. With the public lands remaining unregulated and uncontrolled, there will probably be an increase of 25 per cent in cattle and no material change in sheep. The increase in cattle at the expense of sheep will

be due to the raising of cattle rather than sheep on the farms and ranches. Owing to the large acreage of desert range unsuited to cattle, sheep will probably not decrease.

Better breeding animals and larger increase.—The schedules from stockmen show an average estimate of 70 calves to every 100 cows of breeding age. Individual schedules vary from 35 to 90 per 100 cows. The average is believed to be too high. Although while 90 per cent is exceptional in actual range stock husbandry, there are many such reports among those submitted. By control of the range and provision for full control of the breeding stock the average calf crop should be raised probably 10 per cent, and perhaps a little more, over what it is to-day. On the farms, of course, a 90 per cent calf crop should not be exceptional, but Nevada will be essentially a range State for many years. Further, although Nevada produces good stock, it is believed that with control of the range and a continuance of high prices the general average for a long 2-year-old steer would be 1,000 to 1,050 pounds, instead of 900 to 950 pounds.

NEW MEXICO.

Cattle in New Mexico:	
1910 census	1,082,000
January 1, 1914	980,000
Decrease—per cent	10
Sheep in New Mexico:	
1910 census	3,347,000
January 1, 1914	3,036,000
Decrease—per cent	11
Unreserved and unappropriated public land in State, July, 1914, acres	30,104,843

CHANGE IN LIVE STOCK ON THE RANGE SINCE 1910.

Cattle.—Taking New Mexico as a whole, there has been a general reduction of about 10 per cent since the estimates of 1910. The major portion of these losses appear to have been in the southwestern part of the State and in the north-central part, where, according to the location, there has been a decrease estimated all the way from 6 to 30 per cent. In the southwestern portion some of the reductions are due to the gradual falling off in the carrying capacity of the open ranges used by the cattlemen. In almost the entire eastern half of the State, especially the region along the Texas State line, which is part of the great staked plains of Texas, there is a slight increase in the number of cattle since 1910. In the northern part of this section the increase is due partly to the settlement of very large areas by homesteaders to such an extent that wherever the sheep occupied these ranges they have been almost completely forced out, and the

settlers in the last three or four years have turned to cattle as a means of utilizing the rough forage, kafir corn, milo maize, etc., grown on their dry farming lands, to such an extent that the number of cattle shows an appreciable increase. This holds good for the counties of Roosevelt, Curry, Guadalupe, Quay, and Union. In the southeastern portion of the State, east of the Pecos River, range conditions for several years have been very good, and many cattlemen have increased their holdings. In the extreme northwestern corner of the State, in San Juan, McKinley, and part of Valencia Counties, there has been a moderate increase in the number of cattle, due partly to the taking up of land by settlers, the building of several irrigation projects, and a series of unusually good seasons. Taking it as a whole, however, the number of cattle in the State seems to have decreased slightly. The figures furnished by the stockmen show an average decrease of 12½ per cent, while those furnished by the county correspondents show an increase of 19½ per cent. Considering the two together and the sources from which the information is obtained, it is believed that a loss of 10 per cent for the entire State is approximately correct.

Sheep.—In the northwestern corner of the State there has been a slight increase in the number of sheep in San Juan and McKinley Counties and also in the south-central part in Otero and portions of Eddy and Chaves Counties. There is also a slight local increase in Sierra County west of the Rio Grande. The rest of the State, however, shows a general decrease in the number of sheep. The figures furnished by schedules from stockmen place this decrease at 4.1 per cent, while the schedules from county correspondents place it at 1.3 per cent. Taking the State as a whole, it is believed that the decrease is probably above these figures and that a reduction of 5 per cent between 1910 and 1914 is approximately correct.

FACTORS RESPONSIBLE FOR THE CHANGES.

Homesteaders.—The settlement of land by homesteaders has somewhat reduced the available grazing area. Schedules from stockmen estimate this reduction at 6.2 per cent, against 41.4 per cent reported by the county correspondents. For the entire State it is believed the figures furnished by the stockmen are the more nearly correct.

While the settlers have located lands in every portion of the State, their encroachments upon the ranges have been more marked in the northeastern section of the State, in those counties lying adjacent to the State of Texas, and it is probably safe to say that in these counties the range has been reduced at least one-third if not more. Elsewhere in the State the homesteaders have not, in the opinion of the investigators, encroached seriously enough upon the ranges to make any impression on the handling of the stock.

Change from beef to dairy stock.—There is so far no noticeable change from beef to dairy stock in any part of the State. In one or two isolated localities, especially in Dona Ana County in the southern part and in Colfax County in the northern part, where irrigation projects have been developed to a considerable extent, many new settlers have taken up dairying, but this has been an increase in numbers rather than a change in breeds.

Deterioration of the range.—Generally speaking, the conditions of the range throughout the State have not materially changed in the last 10 years. Here and there the reports indicate a slight falling off in its carrying capacity, but if any change at all has come the indications are that there has been an improvement rather than a deterioration. On the National Forests this improvement is very marked, and upon every Forest within the State the reports indicate that the ranges are carrying an increased number of stock. The schedules from stockmen estimate 32 acres to one cow on the basis of 11.2 months' range; the county correspondents estimate 23 acres. All reports claim this is higher than 10 years ago. This 32-acre estimate is considered fairly satisfactory.

Little or no feeding is done throughout the State, the animals with very few exceptions being grazed on the public ranges the year round. What feeding is done is confined to a few areas in the northern part of the State, where during the spring the weakest of the cows are fed a little hay to carry them through the dangerous period.

Better grade of stock.—As in Arizona, there has been a decided improvement in the grade of stock on the public ranges within the last few years. The average value of the bulls used is shown to be $83 per head. This average, however, does not exhibit the real condition upon the ranges, because, as in Arizona and in most range States, the more progressive stockmen, who are generally the owners of the large herds, have spent large sums in purchasing high-grade and even pure-bred bulls. On the other hand, many of the smaller men either turn out scrubs or else have no bulls at all. There are several large herds in New Mexico, notably in the north-central portion, some of which number as high as 10,000 animals, where every bull used is a pure-bred, the result being an extremely large output of stock greatly above the average of range animals. There are also in the southeastern portion as well as the southwestern portion several large herds, one of more than 50,000 head, another of more than 30,000, where very high-grade bulls are used. These, however, do not offset the large number of scrub and low-bred bulls used in small herds.

Weight of steers.—The average weight of 2-year-old steers sold direct from the ranges is 725 pounds, for 3-year-old steers 934 pounds. As in Arizona, the average is somewhat reduced because

probably 75 per cent of the New Mexico output comes directly from the ranges and is shipped in the early spring months, when the animals are thin and do not therefore weigh out very well.

POSSIBILITY OF INCREASING NUMBER OF STOCK IN THE STATE.

Public ranges.—Practically all the open ranges within the State are occupied to their fullest extent under present conditions, excepting here and there where water development might take care of a greater number of stock. Almost unanimously the schedules indicate that some form of Government control must come before these ranges can be brought up to their full capacity, the belief being that if such control could be secured they would carry approximately 25 per cent more stock than at present. Many individual reporters believe that the passage of the 640-acre grazing homestead bill would tend to bring about the same excellent results, most of them, however, desiring the acreage under that bill to be increased to two or four sections.

Increase from farms and new settlers.—The general opinion expressed in the majority of the schedules is that the new settlers will turn to raising more live stock, probably cattle, and will ultimately increase the State's production very materially; also that the encroachment on the ranges by these settlers has not made any perceptible decrease in the output of cattle, but that it has in sheep. Based upon a careful study of all available data, it is believed that an increase of 20 per cent in the number of cattle and 10 per cent in the number of sheep may be looked for in the next 10 years.

Calf crop.—The estimated number of bulls to the hundred cows is 5, and the average number of calves born for each hundred cows of breeding age is 66. It is noticeable that the reports from the large fenced land grants which are used for cattle raising show an unusually high calf crop, and the owners report the use of more bulls than the average for the State, some of them using as high as eight bulls to the hundred cows. On the open ranges, where the country is very rough, the calf crop is in many instances reported as low as 40 per cent, even with a number of bulls used above the average for the State. It is doubtful if the average number of bulls shown is a true indication of conditions on the range, and it is believed that a conservative estimate for the State as a whole would place the number of bulls at not above three to the hundred cows, and also that the average of 66 per cent increase for the calf crop is far too large when applied to the open range, where probably 50 per cent would be more nearly correct for a period of years.

The sheepmen of New Mexico have not made the progress in breeding up their herds that other sheep-raising States have made.

although here and there individuals have raised the character of their flocks to a very high standard. Taking the State as a whole, however, the breeding of the New Mexico sheep is not up to the average of the other western range States, although the weight of the clip has somewhat increased in recent years.

COSTS.

Labor costs.—The reports of the labor cost involved in handling range cattle are fairly uniform from all parts of the State, the average being $2.77 per head. This cost ranges from as low as 50 cents per head in large herds to as high as $8 per head in very small bunches. As in Arizona, it is not believed that this average shows the true cost of labor for an average herd, the amount probably being below that estimated for Arizona, or not to exceed $1.50 per head. On sheep the labor cost, including shearing, as reported by the Tariff Board, is 56 cents per head, the lowest of all the western States.

Feed cost.—The cost of feed for range animals is the lowest of all the States reporting, being $1.10 per head per year. This is due to the same conditions as exist in Arizona, namely, the use of the open ranges practically the year round. In the northern part of the State the feed cost for handling cattle within the large pastures which are common there is somewhat higher, owing to the fact that owners estimate this cost upon the value per acre of the land inclosed and the cost of fencing and improvements. This feed cost in such pastures, where in some cases as many as 10 and 12 thousand head of cattle are run, is estimated at from $2 to $3, which is approximately correct. It should be understood that in these large pastures considerable feeding of hay is done in the early spring, which adds to the feed cost, as hay in that region is generally high.

The cost of feed for one sheep for a year as shown by the report of the Tariff Board is 18 cents per head. It is probable that this cost, which was estimated in 1911, is somewhat higher at the present time, owing to the fact that since 1911 the sheepmen of New Mexico have made very heavy investments in State lands upon which to handle their sheep. Probably the average per capita cost to-day for actual feed for one sheep is approximately 22 cents per head.

Cost of raising a calf.—In order to ascertain the true cost of a steer, stockmen were requested to furnish an estimate of the feed cost for raising a calf from birth to 12 months of age. These figures differ very widely. The variation is undoubtedly due to the fact that in most instances the individual reporting took into consideration many of the necessary expenses other than feed incurred in raising a calf. On the large pastures in the northern part of the State,

where undoubtedly closer account is kept of such items than on the open range, this cost ranges from $4 to $12 per annum. The individual reporting the $12 per annum cost uses 5 bulls to the hundred cows, each bull being valued at $180 per head, and the per acre valuation of the land is placed at $5. The cows too are all very high-grade stock, and in figuring the cost of the calf, the bull and other charges and the interest on the investment were undoubtedly added to the feed cost. On the open range under ordinary conditions in the larger herds this cost is estimated to be from 75 cents to $2.50 per head, with an average throughout the State of $1 per head, which for actual feed cost is probably correct. Taking the entire State, it is believed the feed cost of raising a calf to the age of 12 months should be not less than $1.50 per head.

Interest.—The average rate of interest as shown by the reports is 10.2 per cent. Very few of the reports show a rate of interest less than 10 per cent, except in the southeastern portion in the Pecos Valley, where cattlemen are able to secure loans at the banks for 8 per cent. This is an exceptional case, however, and the average as established by the reports is undoubtedly correct.

Depreciation.—The majority of the reports indicate that no depreciation is charged against a cow until she has passed the age of 6; after that it is estimated that the yearly depreciation amounts to 5.8 per cent. For bulls past the same age the estimate is 15.4 per cent. As in other States, however, many reports indicate that no depreciation is figured on cows, because after raising three or four calves she is sold as beef for an amount in many instances greater than her original cost.

OREGON.

Cattle in Oregon:	
Census 1910	725,000
January 1, 1914	666,000
Decrease—per cent	8.1
Sheep in Oregon:	
Census 1910	2,699,000
January 1, 1914	2,670,000
Decrease—per cent	1.1
Unreserved and unappropriated land in Oregon, July 1, 1914—acres	15,969,846

CHANGES IN LIVE STOCK ON THE RANGE SINCE 1910.

Cattle.—For the State as a whole it is estimated that the number of range cattle has decreased approximately 10 per cent since 1910. The average of the schedules shows less than this, but the large stock-raising district through the central part of the State shows an appreciable reduction, and local reductions of magnitude are reported from

the eastern part. There has been a marked increase in the counties along the west coast, but it represents dairying rather than range increase, and is on a smaller scale than stock raising in central and eastern Oregon. It is safe to say, then, that the decrease since 1910 is at least 10 per cent.

Sheep.—The county schedules show an average increase of 1.3 per cent in sheep since 1910. The schedules from stockmen show an average decrease of 17.3 per cent. Study of all schedules by counties shows a decrease of 10 to 50 per cent in eastern and north-central parts of the State, no change or a slight increase in the big sheep section of central Oregon, and an increase on the western slope. The decrease in numbers in the eastern part over the actual increase in numbers on the western slope would make the final estimate a still larger decrease than the average deduced from average estimates. It is concluded, therefore, that sheep have decreased 15 per cent in Oregon since 1910.

FACTORS RESPONSIBLE FOR THE CHANGES.

Homesteaders.—The schedules from stockmen show an average estimate of 28.6 per cent of the former range lands homesteaded in the last 10 years. Those from county correspondents estimate 18.7 per cent. Settlement has been rapid in the main range sections of central, southern, and eastern Oregon, so it is safe to estimate that 20 per cent of the former range lands have been homesteaded since 1910.

A study of the schedules by sections shows that only a small percentage of these new settlers are raising live stock over and above the necessary work and milch animals in the main range sections of the State. In the western and southwestern parts they are, but the numbers here do not offset the changes in southern, central, and eastern Oregon. It is believed, therefore, that the average estimate of 9.9 per cent decrease in cattle and 10.9 per cent decrease in sheep, attributed by stockmen to homesteading of range lands, is low rather than high. This decrease, of course, is spread over the last 10 years. For example, it is estimated that homesteading has reduced cattle 33⅓ per cent, and sheep 40 per cent in Grant County; in Baker County, cattle 50 per cent, and sheep 25 per cent; in Crook and Wheeler Counties, sheep 60 per cent; Wasco County, cattle 50 per cent, and sheep 40 per cent. These are important range sections.

Change from beef to dairy cattle.—The department figures of February 7, 1914, show an estimated increase of 23,000 milch cows (13.3 per cent) in Oregon since 1910. Both the county correspondents' and stockmen's schedules confirm this increase. While a general increase over the State is reported, it is believed that the appreciable growth has been in western Oregon rather than in the main range sections of

eastern and southern Oregon. For this reason it is felt that the growth of the dairy industry has had little influence upon the decrease in production of beef animals. The dairy cows are largely an addition to the total rather than an appreciable subtraction from the beef cattle. As dairying intensifies, the dual-purpose cow gives way to dairy breeds, and to this extent, a minor factor to date, beef cattle have been decreased.

Deterioration of range.—For the State as a whole the county schedules show an average estimate of 11.5 acres as the area necessary to support a cow for an average season of seven and one-half months. These reports, however, include many estimates of 2 to 5 acres which are not representative of any body of range lands. The schedules from stockmen show an average estimate of 22.7 acres. These reports are representative of the main range territory, and the estimate of 22.7 acres per cow for 7½ months is considered approximately correct.

Approximately 60 per cent of the reports state that this acreage is higher than 10 years ago; the others are about equally divided between "no change" and lower. The main consistent increase in carrying capacity is reported from the western one-fourth of the State, where moisture is sufficient to grow cultivated forage plants as soon as the land is cleared. The increase is attributed largely to cultivation and reseeding in this section. Throughout the main range section a considerable number report an increase in carrying capacity, but the majority say the range has deteriorated.

For the main range section of southern, central, and eastern Oregon, a majority of the schedules from stockmen show a decrease in carrying capacity. The rest show either an increase or no change. Those reporting a decrease in carrying capacity attribute it to (1) overgrazing; (2) the growth of timber and brush replacing forage; (3) settlers. Under protection against fire, brush and forest reproduction are undoubtedly encroaching upon the range, and mean an unavoidable reduction in carrying capacity of certain National Forest ranges. The main factor, overgrazing, is gradually being remedied on Forest range, and could be remedied on public domain. Settlement is a factor which can not be overcome, but can be offset in effect by growing stock on the homesteads. Those who report an increase in carrying capacity attribute it to (1) National Forest management; (2) better methods of handling the stock; and (3) placing privately owned range under fence, thus protecting it.

The average estimate given where deterioration is reported is approximately 30 per cent; the average estimate for the increase reported is approximately 25 per cent. Considering these estimates and the "no change" reports, as well as the fact that the majority

in the main range section report a decrease in carrying capacity, it is estimated that the range for the State as a whole has decreased approximately 5 per cent in carrying capacity in the last 10 years. The other important conclusion is that range under regulation has improved approximately 25 per cent, and range without protection and regulation has deteriorated approximately 30 per cent.

HOW THE NUMBER OF LIVE STOCK IN THE STATE CAN BE INCREASED.

Public range.—The schedules from stockmen show that all the available range is now used and part of it overstocked, except in the case of one locality in northeastern Oregon, reported unused because of lack of water, and minor local areas elsewhere reserved for campers and other necessary special purposes. The county schedules, which more nearly represent conditions in the secondary range counties, show areas unused in Benton, Gilliam, and Sherman Counties on account of a herd law; local areas also are reported unused in Multnomah, Klamath, and Wallowa Counties, owing to lack of stock. The latter cause, however, is a temporary and exceedingly minor factor. It is evident, therefore, that appreciable increase in live stock in Oregon can not be expected from the opening up of new grazing areas.

Of schedules from county correspondents the large majority say the present ranges could be made to carry more stock; a small number say no. Of the schedules from stockmen, the majority say present ranges could be improved; and a few say no.

The schedules from stockmen best represent the main range sections of the State. The few of these which give figures for estimated possible improvement place it at approximately 20 per cent. This is believed to be about right for southern, central, and eastern Oregon, the main-range lands. The methods suggested for securing this increase are (1) reseeding; (2) Government control; (3) improvement in handling stock, including drift fences, salting, better herding of sheep; (4) water development and trail construction; (5) burning logs and brush; and (6) in the case of one report private ownership. Reseeding, improvement in handling stock, trails, and water development for Oregon are all dependent upon adequate control and regulation of range and stock. So far as present knowledge goes, brush burning, which might be a big factor, is impracticable and inadvisable, because it would destroy young growth of timber, which is a resource necessarily under protection. It may be said, therefore, that improvement of the main range lands depends upon continuation of aggressive work on the National Forests in the way of range management, development, and handling stock, and some form of control for the remaining public-domain lands, so that constructive range work will be possible.

For the western one-fourth of the State improvement centers in the main around clearing and cultivation. Obviously this is the work of private individuals. Continuation of high prices for beef and dairy products is the element needed to bring about this development.

More stock on farms and homesteads.—The schedules from stockmen show an average estimated increase of 16.85 per cent in cattle and 3.1 per cent in sheep during the next 10 years. The county schedules show an estimated average increase of 26.9 per cent in cattle and 11.9 per cent in sheep. The high anticipated increase, as shown by county schedules for the western part of the State, will not increase the total cattle and sheep in actual proportion to the amount shown by counting them in the general average, owing to the small scale of the industry at present. On the other hand, the stockmen's schedules do not fully represent the western part of the State. It is concluded, therefore, that a reasonable estimated increase will be between the two averages, or about 20 per cent increase in cattle and 5 per cent increase in sheep for Oregon in the next 10 years.

Almost without exception this estimate is based upon the belief that high prices, general farm development, increase in forage production, settlement of formerly waste lands, and increased demand for dairy products will result in settlers and small farmers turning to cattle raising. To date the majority of new settlers have not produced stock over and above the necessary work animals and milch animals. With few exceptions it is the belief that they will do so in the next 10 years or sell the holdings to stockmen or farmers who will. Except for the main dairying sections, this expected increase is based largely on the belief that the present comparative prices for beef and grain will continue. It shows, however, a great possibility of developing stock husbandry on Oregon farms and homesteads. Perhaps in no other State do the reports show so large an estimated increase in dairying as in Oregon. This is due largely to the development of logged-off and brush lands on the west slope, where the cost of bringing them under cultivation necessitates intensive agriculture and where precipitation is sufficient to make the cultivated lands very productive. Dairying may reduce the increase in beef production from the estimate of 20 per cent to approximately 15 per cent.

The larger increase in cattle than in sheep is due probably to increase in dairying and to the fact that at the present time and in the near future small farmers and settlers can handle a few cattle more readily than a few sheep. Sheep on farms in Oregon offer no small possibilities, but this factor takes longer than 10 years to develop properly.

Better breeding animals and larger increase.—The development of the stock industry on farms and homesteads, the increased cost of production on ranges as well as farms, the increased care of individual animals due to their individual high value, and the increasing tendency to market by weight rather than by the head will all work toward the improvement of the individual animal and consequently the average. This will apply to increase in calf crop as well as to weight. The average estimate for calf crop in Oregon is 75 calves to each 100 cows. With better care this average should increase perhaps 10 per cent. Oregon produces good cattle today, but there is actual possibility of increasing the average weight, as is shown by the fact that for different localities the weight of a long 2-year-old steer is given from 700 pounds to 1,050 pounds, and sufficient sales by weight have been made to justify accepting the stated weights as reliable.

UTAH.

Cattle in Utah:	
1910 census	412,000
January 1, 1914	444,000
Increase—per cent	7
Sheep in Utah:	
1910 census	1,827,000
January 1, 1914	1,970,000
Increase—per cent	8
Unreserved and unappropriated land in Utah July 1, 1914—acres	33,756,502

CHANGE IN LIVE STOCK ON THE RANGE SINCE 1910.

Cattle.—For the State as a whole it is estimated that the number of cattle on the range has decreased 7½ per cent since 1910. A study of individual reports shows an estimated decrease of approximately 10 per cent in the southern end of the State and in part of Wasatch and Uinta Counties. A slight increase is reported for the central part of the State and in Cache and Rich Counties in the northern part of the State. The latter sections have not gone into fruit extensively and are not situated advantageously for profitable marketing of the large amount of hay grown.

Sheep.—It is estimated that the number of sheep on the range has decreased 14 per cent since 1910. The number of sheep run yearlong on farms in increasing. This fact will probably account for part of the discrepancy between the estimated decrease here given and the estimated increase given in the Agricultural Outlook, February 7, 1914. It is doubtful, however, if there has been any increase in the total number since 1910.

FACTORS RESPONSIBLE FOR THE CHANGES.

Homesteaders.—It is estimated that approximately 10 per cent of the range lands have been homesteaded during the last 10 years. The majority of the homesteaders on the lands taken are not raising live stock over and above the necessary work and milch animals. In the central part of the State and in exceptional cases elsewhere they are, but as a rule they are devoting attention mainly to raising wheat. It is estimated that as a result of this settlement the number of cattle has decreased 3 per cent and the number of sheep 8 per cent. This is due to the fact that much territory formerly used as spring and fall range has been transformed into wheat fields. The problem of securing lambing grounds for sheep is growing more acute each year, owing to settlement of the foothill territory.

Change from beef to dairy stock.—In the central part of the State, especially in San Pete Valley, the number of dairy cattle has materially increased. In the northern part of the State there has been a slight change from beef type to dairy type. In all the southern (arid) part of the State there has been no appreciable change. This change tends to increase the total number of cattle, but decreases the output of beef. Approximately 65 per cent of the reports state that the change thus far has not decreased the output of beef; 35 per cent report that it has. As a whole there has probably been a slight decrease in the beef output, due to increase in dairying.

Deterioration of range.—It is estimated that for the State as a whole an average of 22 acres of the public range will support a cow for the average season of nine months. For the southern part of the State an average of 35 acres is necessary to support a cow through the year; in the central and northern parts an average of about 17 acres is necessary for an average season of eight months.

The schedules as a whole show that in the National Forests there has been an increase in carrying capacity, the stockmen's estimates varying from 10 per cent to 50 per cent, and that on the public domain there has been a decrease in carrying capacity. Forty-eight schedules from county correspondents show an average estimate of 38.6 per cent decrease in carrying capacity. It is doubtful if the average decrease is so high, for the reason that National Forest range has improved, and the large acreage of desert range, which can be used only in winter, has undergone little change. The public-domain range has probably depreciated 20 per cent and the range on National Forests improved at least 15 per cent in the last 10 years, leaving in the aggregate an average of about 5 per cent decrease for the State.

The main factors cited as responsible for reduction in carrying capacity on the public domain are overgrazing and settlers, over-

grazing being cited in approximately 80 per cent of the cases. The increase in carrying capacity is attributed to Government regulation and allotment of range on National Forests, less stock in a few localities, and more rain in recent years. These data all point to proper stocking and regulation of stock as the prime factor in range recuperation and maintenance.

Better grade of stock.—The general tendency toward improvement of the individual animal somewhat at the expense of numbers undoubtedly has had some influence in decreasing the number of stock in the last 10 years. To-day a great many mutton lambs and some beef are sold direct from the range, and feeders are usually in excellent condition. This was true to a much less extent, if at all, 10 years ago. Where the range is all in demand, as in Utah, a decrease in the number of stock per unit of forage is necessary to accomplish this improvement.

HOW THE NUMBER OF LIVE STOCK IN THE STATE CAN BE INCREASED.

Public range.—With the exception of a few localities all of the open range of the State is reported in use. In the southern (arid) part as much as 25 per cent is reported unused, owing to lack of water. The average even for this arid section, however, is much less than this. In the central and northern parts of the State small local areas are reported unused because of lack of water. The whole territory is considered fully stocked or overstocked for its present condition of development and plan of management.

Of the schedules received, however, from stockmen and county correspondents all but a negligible few state that the public range could be made to carry more stock. The means advocated for accomplishing this are: (1) Proper control of the range, usually recommended as Government control; (2) reseeding or revegetation by protection of range; (3) water development. In many instances proper control and water development are given as necessary; in others water development and reseeding; in others reseeding and proper control of range. It may be said that both reseeding and water development depend for success upon proper control, as water development without control means, in the gross, further overstocking, and revegetation with native species, the only practicable method, can not be accomplished without control of all stock.

Only a few of the schedules gave quantitative estimates of the increase in carrying capacity which would follow control and improvement. These varied from 20 per cent to 100 per cent, with an average of 40 per cent. Considering the large acreage which has undergone improvement in National Forests and the desert character of a large area of Utah range, 40 per cent is probably too high as an

average to be expected from the State. It is believed that 25 per cent would be nearer the possible average increase and it will probably require 10 years to bring it about.

More stock on farms and homesteads.—The schedules from stockmen show an average estimate of 22 per cent for the expected increase in cattle within the next 10 years. Those from county correspondents show an average estimated increase of 26.8 per cent in cattle and 6.1 per cent in sheep within the next 10 years. The reasons given in support of these estimates, in order of importance and number of reports, are high prices and agricultural settlement and development.

High prices make stock raising more profitable than grain raising, and old farmers as well as homesteaders will grow more forage and live stock and less grain. New settlers will turn to stock raising as soon as they are supplied with forage and money. The general improvement and development of farms will result in more produce and increased difficulty of marketing at a profit, consequently the present tendency toward feeding beef and mutton will increase. Also this general development will result in increased demand and necessity for more dairying.

In this connection it is estimated that 6 to 8 per cent of the remaining public land is suitable for homesteading. The settling of this land will temporarily further reduce the number of stock, but as the settlers become established and are financially able, they will turn to live stock, provided the present comparative prices for meat and grain continue.

Better breeding animals and larger increase.—The average estimate of calves per 100 cows for the State is 69, but it is doubtful if the average is so high under present conditions. By control of the public-domain lands and provision for legitimate fencing to separate breeding stock from other stock during the breeding season, it should be possible to increase the calf crop 5 to 15 per cent. Also this control would encourage the purchase of better bulls by assuring the purchaser that he and not his neighbor would benefit by such purchase. There is no doubt that the average individual animal on the ranges could be increased 100 pounds in weight.

WASHINGTON.

Cattle in Washington:	
1910 census	402,000
January 1, 1914	433,000
Increase per cent	8
Sheep in Washington:	
1910 census	476,000
January 1, 1914	506,000
Increase per cent	6
Unreserved and unappropriated public land in State July 1, 1914, acres	1,799,774

CHANGE IN LIVE STOCK ON THE RANGE SINCE 1910.

Cattle.—The State of Washington is one of the few States investigated that show an actual increase in the number of both classes of live stock within its borders. A close analysis of the figures relating to cattle indicate that since 1910, in the purely range cattle industry, while there has been a decrease of about 16 per cent since 1910, there has been an increase of about 25 per cent in the dairy stock in this period. The small remaining area of public lands is also an indication of the agricultural development of the State, there remaining unappropriated and unreserved but 1,800,000 out of the original 44,000,000 acres in the State. This increase in numbers appears to have taken place upon the western or coast section of the State, where the dairy industry has been greatly developed within the last few years. On the other hand, the decrease is marked in the eastern part of the State, where the vast foothill ranges formerly occupied by the range cattle have been turned into wheat farms upon which little or no stock is being raised. In the extreme southeastern corner of the State, in the vicinity of one or two of the National Forests, there has been some slight increase in the number of cattle, due to the protection of the range in the Forests, with the possibility of the settlers securing permanent grazing grounds therein. Taking the State as a whole, there has probably been an increase in cattle of about 6 per cent since 1910.

Sheep.—The increase in the number of sheep, so far as the investigators are able to discover, is not confined to any one particular area or section, nor is it due to any one factor. In some of the regions, where a decade ago large bands of sheep were grazed on the open ranges, it is evident that the business has fallen off very materially. On the other hand, there are many scattered areas throughout the State in which it appears that settlers are finding small bands of sheep profitable and the industry has really increased within the last four years, although probably it has not by any means regained the value or numbers that it once attained in the State. The sheepmen of the State have given their attention within recent years more to the production of mutton than of wool, with the result that according to the Tariff Board 82 per cent of the rams used in the State were of the mutton type as against (for comparative purposes) New Mexico, which has but 6 per cent. Owing to this development of the mutton industry, it is probable that within recent years the average weight of the lambs produced on the sheep ranges of Washington has increased at least 10 per cent. There has also been a very general increase in the last decade in the average weight of the fleece of the Washington sheep, which, as shown by the report of the Tariff Board, is greater than in any other of the western States, being 9.3 pounds per fleece.

The view taken by individuals reporting on this matter is that there will be a general increase of from 10 to 20 per cent in the number of sheep within the State during the next few years. The reasons given for such increase are that many of the smaller farmers find in sheep a means of utilizing considerable of the waste upon their farms, especially within the logged-off regions, where the growth of forage and browse plants upon these lands furnishes splendid feed that would otherwise be unused. The general increase in sheep since 1910 may be approximately estimated at 3 per cent.

FACTORS RESPONSIBLE FOR THE CHANGES.

The increase in the farm unit in the State of Washington and fuller utilization of the unit through diversified agriculture and a general move to utilize the logged-off lands within the State is undoubtedly responsible for this increase in numbers of both classes of stock. The new settlers are finding a better market for the products of their farms through live stock and especially dairying, while in some parts of the State the reports indicate that a great many men who went into fruit growing on a rather extensive scale are now turning their attention to more diversified agriculture, reducing their orchard acreage considerably and turning to live stock as a means of more fully utilizing the areas under cultivation. The increased value of all meat animals within the last few years has naturally hastened this development, and from the reports there is a strong probability that this increase will continue for several years.

Better grade of stock.—The schedules all point to a very high individual value for the bulls throughout the State, the average being $124, or second highest of all the States reporting. The average calf crop is also very high, being 79.5 per cent, or approximately 79 calves for every 100 cows. This can be partly accounted for by the fact that most of the holdings within the State are small, and, especially in the dairy herds, the calf crop is much higher than where the stock are grazed in scattered numbers on the open ranges.

Weight of steers.—The average weight of steers for the State is placed at 1,032 pounds for 2-year-olds and 1,235 pounds for threes. The majority of the steers produced on ranges and farms of the State are turned off in the fall ready for market, and the grade of the bulls is reflected in this excellent weight of the steers sold.

Weight of sheep.—Probably some of the heaviest lambs produced on the ranges in the West come from the Washington flocks. These are range sheep and, as stated, the Washington sheepmen, having turned their attention very strongly toward the mutton type, are raising a lamb that is extremely heavy.

COSTS.

Labor cost.—Throughout the State the estimate of the yearly labor cost per head for cattle averages $3.71. There is a wide variation in these reports, strictly range men estimating the cost at as low as $1 per head and others whose feeding periods are rather long estimating them at from $6 to $10 per head. Manifestly the latter figures can not be correct. One of the best-posted stockmen in the State estimates the labor cost at from $2 to $3. In all probability, if a careful analysis could be made of the points considered in making these replies by the various parties to whom the queries were addressed, the average of about $2.50 for labor would not be far from correct. The cattle are grazed on an average of 7.9 months, either on pasture or on open ranges. The rest of the time they are fed some hay, although, owing to the mild climate in the most of the State, the amount of hay required should not be as large as in States like Montana and Wyoming. Notwithstanding these facts, however, the cost of this winter feeding is higher than in any other of the States reporting, being $9.92 per head for the period mentioned. No figures are submitted showing the cost of this feed by the ton, so that it is impossible to state with any exactness whether or not this unusually high feeding cost is due to the high price of the feed itself or to other causes not known to the investigators.

Cost of raising a calf.—The cost of feed for a calf to 12 months of age averages $8.61 for the entire State, which compares very favorably with the cost in most of the other range States, and by careful analysis of the various figures presented and knowledge of the ability of some of the men furnishing them to make this estimate this rate is not believed to be excessive.

Interest.—The average rate of interest throughout the State which stockmen have to pay for carrying on their business is 8.7 per cent, which is somewhat below the average for the States under investigation. Unquestionably this rate is secured by reason of the fact that the live stock business of the State is on a rather sound footing, the owners having well-improved farms as a basis for obtaining such loans.

Depreciation.—The yearly depreciation upon a range cow is estimated at 5.24 per cent, most reporters believing that depreciation should not be considered, owing to the fact that under present conditions, after she has raised a number of calves, the cow is sold for beef for approximately her full value. For bulls the depreciation is established at 14.7 per cent, which is not considered an excessive depreciation rate, considering the high average value of the bulls within the State.

POSSIBILITIES OF FURTHER EXTENSION OF STOCK BUSINESS.

Carrying capacity of ranges.—The reasons given for anticipating a further extension of the stock business throughout the State are varied. The average acreage required to support one cow is estimated by Forest Service reports at 14.4 and by the county schedules at 13.9, with no change in the last 10 years. This undoubtedly is too low, and an average of 20 acres for one cow for eight months is probably more nearly correct. A number of the individuals reporting believe that eventually there will be some form of Government control which will regulate the grazing and thus increase the carrying capacity of the ranges. This, however, does not seem likely, owing to the fact that such a small amount of public land remains to be thus controlled. Many believe that the lands used for grazing purposes can be reseeded and thus increase their capacity. The development of water is also urged, and several reporters believe that if systematic efforts were made to clear off by fire the brush that now exists on many of the ranges a large increase in the number of stock would follow. It has been proven, however, that reseeding operations on the open ranges by artificial means are not productive of results, but that under proper control whereby a rotation in the use of the land by grazing is secured the land will naturally reseed and the forage cover may be restored almost to its primitive condition. Taking this view of the matter, it appears that a majority of the individuals reporting see in some form of Government control the greatest possible means for increasing the number of stock within the State. The schedules from stockmen estimate that in the next 10 years there will be an increase of 25 per cent in the number of cattle, while the county schedules place it at 65 per cent, which is manifestly too high.

In sheep this expected increase is placed at 11 per cent by the stockmen and 21 per cent by the county reporters. Taking all factors into consideration, and studying the increases for the years since 1910, it is believed that a conservative estimate of such increases for the coming 10 years would be 20 per cent for cattle and 15 per cent for sheep.

WYOMING.

Cattle in Wyoming:		
1910 census		767,000
January 1, 1914		587,000
Decrease	per cent	27
Sheep in Wyoming:		
1910 census		5,397,000
January 1, 1914		4,472,000
Decrease	per cent	17
Unreserved and unappropriated public land in State July 1, 1914, acres		31,553,423

CHANGES IN LIVE STOCK ON THE RANGE SINCE 1910.

Cattle.—The decrease in the number of cattle as shown by a comparison of the census of 1910 and the estimate for 1914 is not entirely borne out by the data submitted with the schedules in connection with this investigation. The reports secured by the Forest Service show this reduction to average 5.3 per cent for the entire State, while the figures taken from the schedules of county correspondents place it at 59.9 per cent. The Forest Service report is undoubtedly somewhat lower than it should be, probably because of the fact that the conditions on the Forests are so much better than on the public domain that the proportionate losses have been much less. On the other hand, a loss of 59.9 per cent in four years as shown by the county correspondents' schedules is undoubtedly wrong. Analyzing the various reports received and discarding those which are entirely local in character, it is believed that the general average reduction in cattle throughout the State since the census of 1910 should be placed at about 20 per cent.

There are three areas within the State upon which an increase in cattle is noticeable. In the northern part, in the vicinity of the Bighorn National Forest, there has been a local increase over quite an extensive area of cattle range estimated at 15 per cent. In the extreme eastern part of the State, in Niobrara County, there has been a local increase of about 10 per cent in the number of cattle. In both of these areas the increase is due to improved range conditions and local development. In the southwestern and western parts of the State, on an area covering the southern part of the Bonneville and all of the Bridger and Washakie National Forests and extending thence in a southeasterly direction until it reaches the Hayden and Medicine Bow National Forests in the vicinity of Laramie, there is an area in which the increase is reported at from 15 to 20 per cent, owing mainly to the rapid development of the Green River country in the western part of the State and several large irrigated areas in the open plains region southeast of Lander. The reports indicate that a large amount of range land has in the last few years passed into the hands of the settlers for farming purposes, and contrary to the reports from many of the other States, there is an actual increase in the number of cattle, due to these new farms. Many of these farms, however, are irrigated areas on which only hay is raised, and the settlers naturally have turned to cattle as a means of utilizing the crops produced on their lands. Over the rest of the State, especially in the extreme eastern section, the reduction in actual number has been rather heavy, estimated in the majority of cases at from 20 to 50 per cent. This area is entirely open grazing country, and these heavy reductions are undoubtedly due to a series of seasons

when the rainfall was much below the normal, and thousands of cattle and sheep were forced upon the market to save their owners from heavy loss.

Sheep.—The decreases in sheep, with the exception of a small area in the extreme southeastern corner of the State, in Laramie County, have been very marked. In Laramie County an increase of about 15 per cent is reported, due undoubtedly to local agricultural development. In the rest of the State, however, the loss is high, excepting possibly in the extreme western portion, where, owing to the protection of the National Forests, the numbers seem to have been reduced much less than elsewhere. The decreases shown by the Government figures of 1910 and 1914 (17 per cent), those furnished by the stockmen's schedules (28 per cent), and those furnished by the county schedules (21.9 per cent), are so reasonably close together that it is fair to assume for comparative purposes that the reduction over the entire State is about 22 per cent. The causes leading up to these reductions in sheep are several; the main cause, however, was a series of very dry years, especially the year 1910–11, when large numbers of sheep in the eastern part of the State either died from starvation or were forced on the markets to save them from that fate. Another cause was the feeling on the part of many sheepmen that business conditions and changes would bring about a decided slump in sheep values. This feeling led them to put their herds on the market in anticipation of such losses, which happily did not follow. A third cause was the fact that for several years the Wyoming sheepmen sold almost their entire annual crop of lambs, without retaining the female lambs to fill up the gaps in their herds or replace ewes that had passed the safe limit of age. The result of this has been that during the last two years the Wyoming sheepmen, in common with sheepmen in several other western States, have found themselves with practically 75 per cent of their flock composed of aged ewes which should have been sold before. These were also forced upon the market and thus added to the general loss in numbers. Under present conditions of handling sheep in the State and the outlook for high prices of wool and mutton, it is believed that the downward trend in numbers in Wyoming has ceased and that a very considerable increase will be shown by the next annual census.

The sheepmen of Wyoming have spent large sums in building up their flocks, especially in producing the mutton breeds of sheep in preference to the Merino type, which is produced more for wool than for mutton. In the western and southern portions of the State, where the sheep are summered on the high mountain ranges, the mutton breeds are almost universally raised, while on the open prairie country the Merino-Rambouillet type is the favorite.

FACTORS RESPONSIBLE FOR THE CHANGES.

Homesteaders.—The coming of the homesteader in Wyoming has not caused any particular reduction in the number of live stock raised in the State; on the contrary it probably has somewhat increased the number of cattle, and this situation will not be greatly changed in the future. There will probably be a still greater growth of the cattle industry in the northwestern portion of the State, where, in the Green River Valley, there are still large areas suitable for homesteading upon which hay can be economically produced. This will add to the number of cattle now there.

Better grade of stock.—The average value of the bulls used is shown to be $160, which is none too high considering the unusually high class of bulls used on the majority of the ranges within the State. Wyoming has a fairly satisfactory law regarding the use of any but pure-bred bulls on the range, the results of which are shown by the high grade of beef steers produced. The number of calves born for each hundred head of cows of breeding age ranges from 60 to 95, the latter percentage being reported from the ranges in the Jackson Hole region. Conditions under which cattle are grazed in the Jackson Hole country are unusually satisfactory and favor the production of a very large calf crop. Taking the State as a whole, however, it is safe to estimate the annual calf crop at the average shown by the schedules—73.3 per cent.

Weight of steers.—The average weight of steers from the ranges in the western part of the State is placed at 1,075 pounds for 2-year-olds and 1,300 pounds for 3-year-olds, while in the eastern part of the State, on the open ranges, where conditions for putting on weight are not so good, the average is 737 for twos and 1,155 for threes.

POSSIBILITY OF INCREASING NUMBER OF STOCK IN THE STATE.

Public ranges.—With the exception of the ranges in the northwestern portion of the State, in the Green River Valley, upon which some increase can be loked for, the ranges are occupied to practically their full capacity under present conditions of range management. A large number of the reports coming from cattlemen attribute the decrease in the carrying capacity of the range and the consequent falling off in numbers to overgrazing and the presence of too many sheep on the range. A good many stockmen make the statement that some form of control of the open range must come before any increase in its carrying capacity can be looked for, and they see no possibility of improvement, except under strict Governmental control, along the lines followed on the grazing lands within the National Forests. There is no particular lack of water on the Wyoming ranges, and as far as watering facilities are concerned the

ranges are nearly all of them capable of being fully used with the present watering facilities. The average number of acres required for one cow for the 8-month period is given by stockmen's estimates at 25.8, while the county estimates place it at 20.6. For the land still available this average should doubtless be close to 30 acres for a cow.

Increase from farms and new settlers.—There will undoubtedly be a marked increase in the number of cattle and perhaps a slight increase in the number of sheep due to new farms and settlers on lands not at present under cultivation.

A careful estimate of the possible increases in the number of live stock in Wyoming during the coming 10 years would be 20 per cent for cattle and not more than 2 per cent for sheep.

COSTS.

Labor cost.—Taking the State as a whole, the estimates of the labor cost involved in handling cattle on the ranges are somewhat higher than in the Southwest, the average for the State being $2.33. This is probably very nearly the true figure. The cattle are grazed for about 7½ months and fed about 4½ months. It is during the months when the animals are fed that the labor cost mounts up. On sheep the labor cost, including shearing, as reported by the Tariff Board, is 72 cents per head, which is somewhat higher than for other States in that vicinity.

Feed cost.—The cost for feed for range cattle during the seven months they are upon the range averages for the entire State $3.72, while the cost of feed during the period they are fed hay is $6.64, making the total annual charge for feed amount to $10.36 per head, based upon market value of hay consumed, and not upon the actual cost of raising it. In most of the hay-feeding regions the average price per ton for hay is from $5 to $8 in the stack. Many estimates as to the cost of placing the hay in the stack were secured. They range from $1 to $2.25 per ton, which includes, of course, only the labor and upkeep of machinery used in haying. On a basis of actual cost of the hay to the stockman the feeding cost would be considerably reduced.

The cost of feed for one sheep per year, as shown by the Tariff Board, is 36 cents, which is lower than for any other of the northwestern States. This low rate, however, is due to the fact that comparatively few of the Wyoming sheepmen feed their flocks during the winter season, as that State has within its borders a very large area of superior winter sheep range upon which, excepting during extreme winters, the losses are seldom severe and the hay feeding not often necessary. There is now a tendency, however, on the part of the

more progressive sheepmen to provide more hay than formerly, and the average cost for sheep feed is probably at the present time somewhat higher than that shown by the Tariff Board report, which was made in 1911. Probably a feed charge of 45 cents per head for Wyoming sheep would not be far from correct under present conditions in the State.

Cost of raising a calf.—The average cost of feed for raising a calf to 12 months of age is found to be $8.65. In the western part of the State, in the Green River country, this estimate is placed at $9.33, while in the Jackson Hole region it is placed at $6. Taking the State as a whole, it is believed that the average of $8.65 is approximately correct.

Interest.—The average rate of interest as shown by the reports is 9½ per cent. This is undoubtedly due to the fact that the majority of the Wyoming cattlemen are prepared to feed their cattle during the hard winters, thus preventing the losses that heretofore occurred where feed was not so provided. They are, therefore, able to secure loans from their bankers at much more favorable rates and on much better terms than cattlemen in the Southwest.

Depreciation.—The average yearly depreciation of cows after 6 years of age is estimated at 3.6 per cent, on bulls after 4 years of age 18 per cent. Wyoming cattlemen are as a rule inclined to dispose of a bull after three years' use, and this depreciation is not believed to be excessive, although under present conditions many of their bulls bring unusually high prices for slaughtering purposes. Their high average cost originally, however, leaves a very considerable gap between this cost and their value as beef animals.

Cost of a 2-year-old steer.—In the northwestern portion of the State, where there is a fairly constant cost and conditions do not change much from year to year, a number of experienced cattlemen reported that, taking one year with another, the cost of producing a 2-year-old steer and getting him to the railroad for shipment was between $22 and $25. Based upon the figures given in the various schedules, the cost of raising a 2-year-old steer appears to be somewhat more than this, or approximately $46.18. These figures, however, are believed to be somewhat higher than they should be, owing to the fact that the hay fed is taken at its market value and not its cost. Again the growth of a heifer calf into a $50 cow is not taken into consideration, as well as several other factors relating to cost which will change the amount considerably. Careful analysis of all the figures submitted and data secured in other ways indicates that $35 is probably a fair general average for such a cost, which includes labor, feed, losses, depreciation, bull service, and all the other items entering into the production of a beef animal except interest.